This thorough and visionary compilation of observations, science and conservation challenges of paddy rice field ecology comes at an especially critical time in our species' and our planet's history. As global drying and global wetting erode the sustainability and dependability of precipitation regimes around the world, it is essential to have authoritative studies like this one which organize and document centuries of accumulated biodiversity and biocultural heritage represented in similarly threatened cultural landscapes. Relatedly or not (most probably related), planetary climatic and biospheric shifts also accelerate at a time when our species demographically trends away from rural and agrarian habitation and landscape maintenance. The related ecological knowledge resources which underpin these ecological worlds are perhaps even more timely to engage and document. Kotowski, Nowak and Nowak have done humanity a very important service in generating an exemplary globally relevant volume, one which I hope is replicated in quality and structure on the subject of numerous additional cultural eco-types.

Jeffrey Wall, Department of Horticulture, Washington State University

As someone who has conducted inventories of useful plants in agricultural landscapes, I want to emphasize the value of this work as a model for research in other areas. I also see tremendous promise for this work to facilitate knowledge exchange among rice-producing communities; any reader familiar with the plants around rice paddies will gain new insights as to the potential uses and other values of those plants. I am hopeful that in sharing such knowledge, the work will contribute to plant stewardship, including a shift in perspective among those who would otherwise dismiss the value of non-cultivated species.

Morgan Ruelle, Department of Sustainability and Social Justice, Clark University

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Ethnobotany of Paddy Plants
Traditional Knowledge, Diversity and Conservation

I

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VOLUME I: *ABUTILON–CLEOME*

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Ethnobotany of Paddy Plants

Traditional Knowledge, Diversity and Conservation

Volume I: *Abutilon - Cleome*

MARCIN KOTOWSKI

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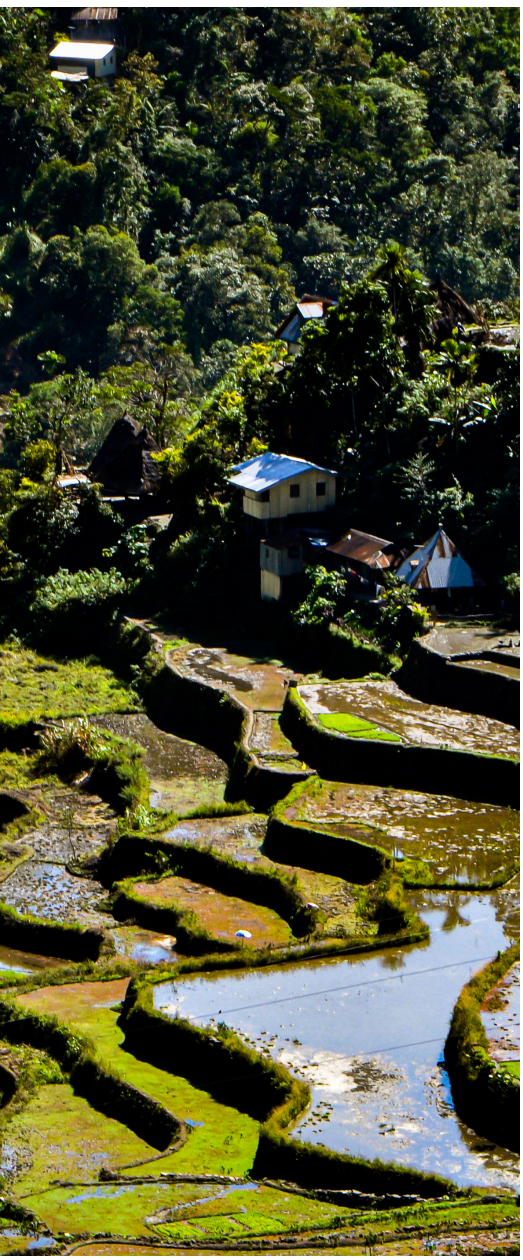
ARKADIUSZ NOWAK

Fig. 1. Banaue Rice Terraces built by the Ifugaos by hand some 2,000 years ago. UNESCO World Heritage Site. Photo. A. Nowak, 2014

Introduction:



Global significance of rice paddies

Rice (*Oryza* spp.) is the principal staple for more than half of the world's population, grown in over 100 countries with 90% of production concentrated in Asia, which also influences the number of publications on rice cultivation in this region (see Methods; Fukagawa and Ziska, 2019). The name "rice" itself usually refers to two independently domesticated species: Asian rice (*Oryza sativa*) and African rice (*Oryza glaberrima*). Approximately 165 million hectares of rice paddies worldwide sustain this cornerstone of global food security (Chauhan, 2013; Statista, 2025), which is comparable to the total area of countries such as Iran or Mongolia. FAO data indicate that rice production in 2023/24 was about 524 million tonnes as milled rice. Global consumption in 2025/26 is expected to reach about 551 million tonnes. This is related to the steadily growing demand for this commodity (FAO, 2024, 2025a). In many Asian countries where rice is the staple food, rice is estimated to be the source of about 30% of dietary energy and 20% of protein. There are also countries where rice provides more than half of the calories and protein per capita (Kennedy et al., 2002).

However, rice is not the only product provided by its cultivation. Seasonal fishing in rice fields accounts for a significant proportion of inland catches and animal-based food in households in mainland Southeast Asia. For example, about 33% of Cambodia's inland fish production is attributable to rice habitats, with about 60% of the fish and aquatic animals consumed by rice-farming families coming from these habitats (Freed et al., 2020a, 2020b).

Edible and medicinal plants found in and around rice fields also serve as a food security measure and a source of income, primarily during periods of food scarcity. Ethnobotanical studies conducted in Laos have identified 115 wild herbaceous plant species in rice-growing areas, of which 25 were consumed and 22 were sold in local

markets (Kosaka et al., 2013). Research conducted in Chinese Hani terrace systems in Yunnan, China has identified more than 200 species of wild edible plants native to these areas, which supplement the local diet as vegetables, spices and fruits (Luo et al., 2019). These plants are primarily important as sources of micronutrients, diversifying the rice-based diet (Halwart, 2006).

Beyond food provision, rice paddies hold deep cultural and ecological importance (Nowak et al., 2015; Talhelm, 2022; Verma et al., 2025). For millennia, they have shaped landscapes and traditions across Asia and Africa. Terraced rice fields and irrigated paddies are not only agricultural systems but also culturally iconic landscapes, often tied to festivals, rituals, and heritage of local communities.

Fig. 2. Rice paddies on volcanic deposits in Penebel, Bali. Photo. A. Nowak, 2014

Ecologically, rice paddies function as artificial wetlands – seasonal aquatic habitats that can support rich biodiversity. They act as floodwater retention basins and groundwater recharge zones, and provide habitat for a diverse array of flora and fauna adapted to flooded conditions. Indeed, traditional rice field mosaics are sometimes described as "temporary wetlands" that harbour many of the same species found in natural marshes and ponds. In parts of Asia, farmers have long practiced integrated rice-fish farming, Recognising the paddy's dual role as cropland and aquatic ecosystem. Despite being human-made, well-managed paddies thus deliver ecosystem services akin to natural wetlands – from supporting wildlife to maintaining ecological balance. The multifunctional role of rice fields as a reservoir of rich wetland and aquatic flora, a great diversity of fauna, an area of diverse wetland habitats, useful plant resources and fish, and above all for feeding the human population and sustaining traditional life and culture, cannot be overstated and deserves special attention. (Bambaradenyia et al., 2004; Edirisinghe and Bambaradeniya, 2006; Nowak et al., 2015; Settele et al., 2018; Freed et al., 2020a).

Purpose and structure

This work focuses on highlighting the natural and cultural significance of the diversity of plants found in and around traditional rice-growing landscapes. Based on extensive field research and a multilingual synthesis of published and archival sources, it provides detailed descriptions of plant species associated with rice cultivation. These descriptions include a collection of local names, information on distribution and habitat, and a compilation of previously recorded ethnobotanical knowledge. In the descriptions of the plants' uses, we include traditional knowledge as well as the results of peer-reviewed research in the fields of

chemistry and pharmacology. In cases where traditional knowledge is not yet supported by experimental evidence, we mark this as a research gap and a priority for future research. The catalogue of rice-field plants is supplemented with high-resolution photographs of the species, including their diagnostic features. Although not a field guide, the atlas is designed as a reference point for practice and policy in rice cultivation systems. To guide the Rreader through heterogeneous agroecosystems, the introduction first presents a species-independent typology of rice fields that applies to both *O. sativa* and *O. glaberrima* cultivation systems. The following chapters present the regional context, followed by alphabetically ordered species descriptions. In practice, the atlas can serve as a tool for scientists, farmers, teachers, and agricultural advisors to facilitate the identification of locally important plants, along with information on their potential value. Furthermore, agricultural policymakers and wetland managers will find evidence for the integration of non-cultivated species into agri-environmental management measures. Ethnobotanists, agroecologists, nutritionists, and food system researchers will find comparative materials and source materials that speak to the biocultural significance of rice-field flora. This function is particularly important in the context of the ongoing intensification and homogenisation of agriculture. By placing local names, photographs, uses, and habitats side by side, the book also serves as a tool for the exchange of knowledge between people involved in rice cultivation. Finally, the atlas aims to reframe plants that are often considered troublesome weeds as an important biocultural resource.

Fig. 3. Rice fields on river bar deposits in Zeravshan Valley near Pandzhakent, Tajikistan. Photo. S. Nowak, 2014.

Fig. 4. Rice fields on the orange ferralsols near Kwembago, Tanzania. Photo. S. Nowak, 2023.

Classification of rice paddy types

Rice paddies have been classified in various ways, combining formal international typologies with traditional local categories. International frameworks (such as those by FAO and IRRI) typically categorize rice ecosystems by water source and depth—e.g., irrigated vs. rainfed; upland vs. lowland; deepwater vs. tidal – whereas traditional classifications often emphasize landscape position and local farming practices. For instance, ecologists distinguish five broad rice environments by water regime: irrigated rice, rainfed lowland, deepwater (floating) rice, tidal wetland rice, and rainfed upland rice. At the same time, farmers in different regions use indigenous terms to classify paddies by terrain or method (such as terraced mountain fields or broadcast-seeded fields). Integrating these perspectives, rice paddies can be described along several key dimensions: topography and hydrology, water management, planting method, and ecological conditions, with regional examples illustrating each category (FAO, 2010, 2025b; Mokkamul, 2006). The choice of variety usually depends strictly on the water and stress conditions of each type of rice field. For example, modern, semi-dwarf, high-yielding *indica* and *japonica* varieties are most commonly found in irrigated lowlands (GRiSP, 2013). In contrast, in rainfed upland areas, drought-resistant and weed-competitive varieties are preferred. An example of this is the upland NERICA - an interspecific hybrid of *Oryza sativa* × *O. glaberrima*, which was bred specifically for upland conditions (Fukuta et al., 2012). There are also varieties grown in fields prone to sudden flooding. In these fields, farmers grow varieties with the Sub1A

gene, a submergence-tolerance gene that allows them to survive complete flooding for one to two weeks by conserving energy and limiting unnecessary elongation (Xu et al., 2006). Deepwater and floating systems use local varieties with strong elongation responses. These varieties contain transcription factors, known by the telling name SNORKEL1 and SNORKEL2 (SK1/2), which trigger rapid internode growth, keeping the leaves above the rising water (Hattori et al., 2009). Coastal and estuarine fields favor salt-tolerant local varieties (e.g., Pokkali) (Thomson et al., 2010). There are also varieties selected for their temperature tolerance. Examples include *japonica* varieties carrying genes such as bZIP73 and CTB4a (Liu et al., 2018; Zhang et al., 2017).

Rice paddies are often defined by their landscape position and hydrological context. Major topographic/hydrological types include:

— Terraced mountain paddies: Built on steep slopes as successive terraces, these paddies allow rice cultivation in hilly or mountainous terrain. They are mainly rainfed. Examples include the Ifugao rice terraces of the Philippines (*payoh*) and the Longsheng and Hani terraces in China (*titan*) (FAO, 2006; Adachi, 2007).

— Valley-bottom and floodplain paddies: In many regions, rice is grown on flat or gently sloping valley floors, river floodplains, and low-lying basins. These paddies benefit from natural drainage patterns—e.g., seasonal river overflow or runoff accumulation—resulting in waterlogged fields during the rainy season. In West Java, Indonesia, such fields are referred to as *sawah landeuh* (lowland irrigated paddy fields) or *sawah ranca* (fields with abundant water, typically found in valleys or floodplains) (Iskandar and Iskandar, 2022).

Fig. 5. Terraced rice fields in the Sinja Valley, Nepal, Photo. M. Kotowski, 2022.

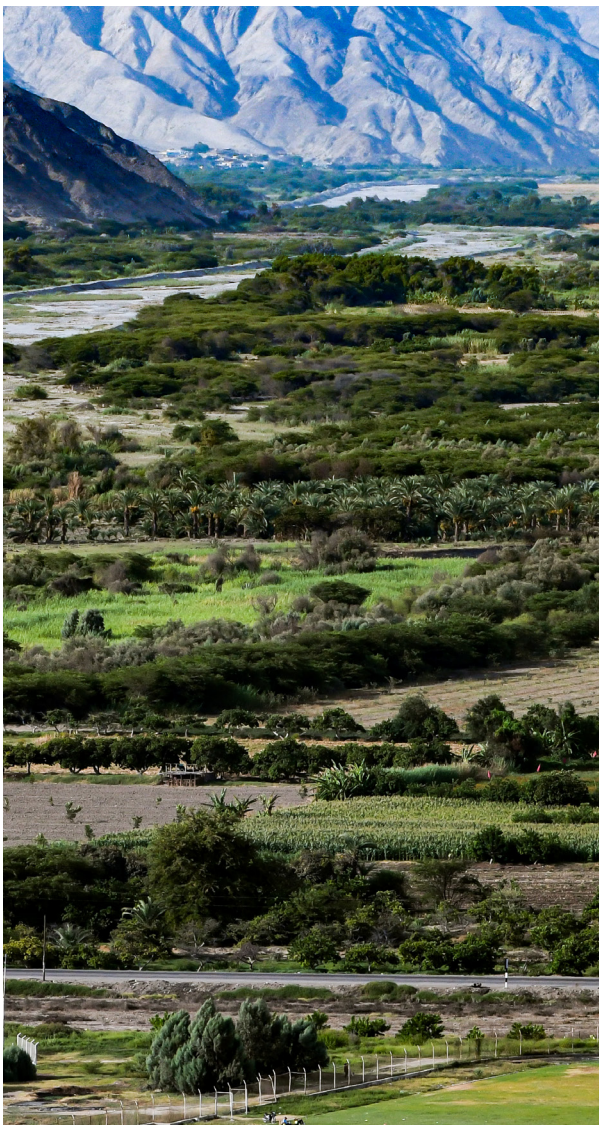


Fig. 6. Rice fields in the river valley near Chipchipa, Peru. Photo. A. Nowak, 2024.

— Rainfed lowland paddies: These are bunded lowland fields in relatively flat areas that depend primarily on direct rainfall (with little or no irrigation). Farmers construct small dikes around fields to retain rainwater. During a good monsoon, rainfed lowland paddies remain submerged for part of the growing season (often holding 10–50 cm of water), but they can suffer drought stress or complete drying if rains are delayed. This category is widespread in South and Southeast Asia (e.g., northern Thailand) on gently rolling or low plains outside major irrigated schemes (Yodda et al., 2020).

— Deepwater and floating paddies: In certain deltaic and floodplain environments, rice is grown in fields that become deeply flooded – water may rise above 50 cm and up to several meters. These deepwater paddies occur in low-lying swamps, estuaries, and river valleys (e.g., the central plains of Cambodia, the Mekong Delta, and parts of Bangladesh). They are typically rainfed at first, then inundated by swollen rivers later in the season. Farmers here cultivate special rice varieties that can elongate rapidly to survive submergence. Floating rice varieties (a subset of deepwater rice) can even grow 10–20 cm per day to keep pace with rising floodwaters. Historically, millions of hectares in South Asia and West Africa were planted with deepwater rice, though many such areas have since been converted to controlled irrigation. An example is Aman rice grown in the flood-prone Bengal delta, or the traditional floating rice in the Tonle Sap floodplain of Cambodia. In Bengal and Bangladesh this type of paddy is known under the name *Jali Aman* (Taylor, 2000).

— Estuarine and mangrove paddies: At river deltas and coastal fringes, rice is cultivated in brackish-water environments such as tidal flats and reclaimed mangrove swamps. These tidal wetland paddies experience saline or brackish flooding during high tides, requiring salt-tolerant rice varieties. Farmers often build sluice gates or dikes to manage saltwater intrusion and flush fields with fresh water when available. For instance, in the Mekong Delta of Vietnam and the coastal Sundarbans of Bangladesh, rice is grown in fields influenced by tides; varieties with tolerant of salinity are critical in these systems. In West Africa, mangrove swamps have long been converted to rice fields (*bolangha*) by constructing earthen dikes to keep out tidal saltwater – a practice common in Guinea-Bissau, Sierra Leone, and Guinea (Garbanzo et al., 2024).

— Upland rice fields: although not paddies in the strict sense (since they are not typically flooded), upland rice fields are located on flat or sloping dry

land without bunds and without standing water. These fields rely entirely on rainfall, and soils are well-drained. Upland rice cultivation is common in parts of Africa, Southeast Asia, and Latin America, often through slash-and-burn (swidden) methods on hillsides. For example, Indonesian farmers distinguish *ladang* (dry swidden fields for upland rice) from *sawah* (wet paddies) in their traditional vocabulary (Iskandar and Iskandar, 2022). While upland fields yield much less than paddies (<1.5 t/ha), they are critical for rice production in areas where constructing irrigated paddies is not feasible (e.g., upland areas of Laos, Northeast India, or Madagascar's highlands).

Another way to classify rice paddies is by water management regime during the cropping season. Rice fields differ in how continuously they are flooded or how often they dry out, which affects rice growth and ecology:

— Permanently flooded paddies: In traditional irrigated systems, fields are kept continuously inundated with a layer of water throughout most of the growing season. Farmers maintain a stable water depth (often 5–15 cm) from transplanting until near harvest. This continuous flooding (also called permanent ponding) has agronomic benefits: it suppresses weeds and promotes nutrient availability in submerged soil (IRRI, 2017). For example, in lowland irrigated paddies of East Asia, a constant water level is maintained via canal irrigation. Even in terraced systems like the Ifugao terraces, farmers keep soils wet year-round, including the post-harvest period, to prevent the walls from drying and cracking (FAO, 2006). Permanently flooded paddies have anaerobic soil conditions and are associated with higher methane emissions, but they generally produce high yields if water is ample (Sess et al., 1990). Nevertheless, soils subjected to flooding-induced anaerobic conditions are a significant source of greenhouse gases, such as methane (CH_4) and, for some fertilisation and drainage systems, nitrous oxide (N_2O) (Qian et al., 2023). Globally, rice cultivation accounts for approximately 8% of anthropogenic methane emissions and about 1.7% of total greenhouse-gas emissions, the majority of which are CH_4. Within agriculture, it contributes roughly 22% of CH_4 emissions and about 11% of N_2O emissions (FAO, 2023; IPCC, 2022; Qian et al., 2023).

Fig. 7. The rice fields in mountainous territory of the Shirakawa-gō village in Toyama Prefecture, Japan. Photo. S. Nowak, 2019.

— Seasonally flooded paddies: These are fields that are inundated for only part of the year, usually corresponding to the rainy season, and then dry out in the off-season. Seasonal flooding

is typical of rainfed rice ecosystems and floodplain agriculture. Paddies are prepared and sown with the onset of the rains; water accumulates and may stand for weeks or months, but as rains cease or floodwaters recede, the field eventually drains. Most rainfed lowland paddies fall in this category – for instance, fields in the monsoonal tropics that flood during the monsoon and lie dry or are used for other crops in the dry season. Deepwater rice fields are an extreme case: they flood deeply in the wet season and become dry land (or shallow-water bodies) once the flood season ends (IRRI, 1984).

— Intermittently flooded (Alternating wet and dry) paddies: In some systems, fields are neither permanently flooded nor simply wet-then-dry by season, but instead undergo multiple wetting and drying cycles within a single growing season. This can be due to water management or weather patterns. For example, farmers practicing alternate wetting and drying (AWD) irrigation intentionally allow the paddy water to recede periodically before re-irrigating, rather than maintaining continuous submergence (Richards and Sander, 2014). Under AWD, rice paddies are intermittently submerged and dried, causing the soil to cycle between anaerobic and aerobic conditions. This method, promoted in modern water-saving agriculture, reduces water use and methane emissions while maintaining yields in many cases (Runkle et al., 2019).

Fig. 8 . Fallow lands in rice paddy farm with abundance of wetland plants. Bali, Indonesia. Photo. A. Nowak, 2014.

Rice paddies can also be categorized by the planting system used to establish the crop. The two fundamental systems are transplanting seedlings and direct seeding of rice, each with variations:

— Transplanted rice paddies: This traditional method involves raising rice seedlings in a nursery (or a small puddled plot) and then transplanting the young seedlings into the main field. The paddy is typically kept flooded or saturated during transplanting. Transplanting is labor-intensive but has advantages: seedlings get a head start and can establish in a weed-free, puddled field, leading to better early growth and weed suppression (Ismail et al., 2012).

— Direct-seeded rice paddies: In direct seeding, rice is sown in the field where it will grow, rather than being transplanted. Direct seeding can be done by broadcasting seed across the field or by drilling (sowing in rows using tools or machinery). It may occur on dry soil (dry seeding) or onto wet puddled soil or even standing water (wet seeding), depending on the technique. Direct seeding has become more common in many regions due to labor scarcity and the availability of herbicides to control weeds. For example, farmers in parts of Malaysia, Sri Lanka, and the Philippines now often broadcast pre-germinated seeds onto puddled fields (a wet direct-seeding method). In Northeast Thailand, the practice

Fig. 9. Abundant *Limnophylla heterophylla* in paddy field in Sumatra, Indonesia. Photo. A. Nowak, 2015.

known as *na waan* refers to sowing rice by scattering seeds on a prepared field, in contrast to transplanting (Kanchan and Kono, 1996; Manilerd and Kesten, 2000).

Each type of rice paddy can also be described by its ecological characteristics – including typical water depth, soil properties, salinity, topographic context, and relationship to natural ecosystems. These factors often correlate with the classifications above but add detail on the environmental conditions of the paddy.

— Water depth and duration: Paddies are often classified as shallow, medium, or deep water based on how much flooding they experience. Shallow-flooded paddies (0–30 cm water) are the norm in irrigated and rainfed lowlands; medium-deep (30–50 cm) occurs in some rainfed areas; and deepwater paddies (>50 cm) are found in flood-prone areas. The most extreme "floating" rice areas can see water depths of 1–6 m at peak flood (IRRI, 1977).

— Soil types: Rice paddies are typically on paddy soils—often clay-rich, poorly drained soils that can be puddled to retain water. Over years of flooding and draining, these soils develop unique features like a dense plow pan and gleyed (anaerobic) subsoil (Yi et al., 2020). However, soil characteristics vary widely by region. In Northeast Thailand, for example, rainfed fields are further subdivided by soil type (e.g., *din sai* for sandy soils and *din tom* for loamy soils) (Yodda et al., 2020). In river deltas and coastal wetlands, acid sulfate soils are common; these soils, when drained, produce sulfuric acid, leading to very low pH. Coastal paddy farmers (e.g., in parts of Vietnam's Mekong Delta or Indonesia's Kalimantan) contend with acid sulfate patches and must manage water carefully to avoid oxidation of sulfides (Husson et al., 2000). In contrast, inland valley paddies in Africa often have richer alluvial or

organic soils but may suffer iron toxicity in stagnant water (Chérif et al., 2009). Upland rice soils are typically well-drained loams or sands with lower fertility. Farmers have traditionally matched rice varieties to soil type – for example, certain landraces perform well on sandy soils, others on heavy clays.

— Salinity and water quality: As noted, saline paddies form a distinct ecological niche. Estuarine paddies encounter brackish water. Rice here must tolerate salinity, especially at the seedling stage. In West Africa, particularly in Guinea-Bissau, the type of mangrove rice fields (*bolanha*) is further classified by the local community according to their salinity level. Thus, *bolanha salgada* refers to rice fields reclaimed from mangrove swamps that are prone to saltwater intrusion (Garbanzo et al., 2024). In South Asia's coastal Sundarbans, farmers grow traditional tall varieties that endure occasional saline floods and deep water (Chattopadhyay et al., 2019). Likewise, in West African mangrove rice culture, varieties have been selected for salt tolerance. In these systems, the paddy ecosystem may include halophytic (salt-loving) weeds and brackish-water aquatic life (Agyen-Sampong, 1991). On the other hand, freshwater paddies in river valleys might receive nutrient-rich silt but also pollution or mineral toxicities depending on water source (e.g., arsenic-contaminated irrigation water is an issue in some parts of Bangladesh) (Meharg & Rahman, 2003). Water quality is thus an important ecological factor – clean, well-oxygenated water vs. stagnant, anoxic water

Fig. 10. Invasive *Argemone mexicana* on bulks of rice paddies near Mateves in Tanzania. Fot. S. Nowak, 2023.

can influence soil chemistry (affecting methane emissions, nutrient forms, etc.) and rice health.

— Topography and relation to natural ecosystems: paddies are essentially human-made wetlands and often integrate with natural ecosystems. Lowland rice fields in floodplains and deltas can replace or coexist with marshes, swamps, or seasonally flooded grasslands. For instance, deepwater paddies in the Mekong Delta or the Ganges Delta occupy what were historically wetland habitats – they still harbour aquatic fauna like fish, snails, amphibians and support migratory waterfowl. In fact, the flooded rice agroecosystem is sometimes considered a surrogate wetland that maintains biodiversity (e.g., the rice-fish systems where farmers harvest fish from paddies) (Halwart and Gupta, 2004). Rice paddies along rivers (riparian paddies) benefit from silt deposition and also buffer the river by absorbing floodwater – they are part of the riparian zone's ecology. In inland valleys of Africa, rice paddies are situated in the valley bottoms (Fr. *bas-fonds*) that are akin to small wetlands; they receive runoff from surrounding forests and savannas, and their irrigation outflow feeds streams. Upland rice fields, on the other hand, border forest or grassland ecosystems and often involve shifting cultivation that is closely tied to the fallow cycle of secondary forests. Terraced paddies in mountains transform the local ecosystem profoundly – they create a tiered wetland from foothills to hilltops, while forests usually remain above them and act as watersheds. The *muyong* forests above the Ifugao terraces, for example, are preserved woodlots that regulate water for the terraces, demonstrating the integrated nature of paddy ecosystems with surrounding natural systems (Daguitan et al., 2023).

Diversity of weed flora in rice agroecosystems

Fig. 11. Species rich stand of rice plants in paddies near Tacuaritas, Argentina. Photo. A. Nowak, 2014.

Rice agroecosystems host a distinctive and often highly diverse weed flora. The term 'weeds' is used here in a neutral sense. In this study, it refers to all vascular plants (ferns, gymnosperms, angiosperms) that occur outside their designated place in the rice cultivation system (Radosevich et al., 2007). Unlike upland crop fields, flooded rice paddies create a unique habitat for aquatic and semi-aquatic plants. In addition, balks, bunds, embankments, and terrace walls provide a complementary habitat for many seed- and spore-bearing plants. As a result, rice weed communities are composed of species not typically found in dry farmlands, and they vary greatly across different regions of the world (Barrett and Seaman, 1980). Below, we summarize the weed flora diversity in rice paddies, with examples from Asia, Africa, and the Americas, as the main rice-growing regions.

South, Southeast, and East Asia

The biodiversity of paddy weeds in Asia is remarkable, reflecting long co-evolution with rice cultivation in varied environments. In the Himalayan country of Nepal, for instance, traditional rice fields support a rich assemblage of wetland weeds. Surveys in central Nepal documented over 80 weed species in spring rice fields. These include many hygrophilous (water-loving) herbs such as *Lindernia ciliata*, *Ammannia multiflora*, *Ludwigia perennis*, *Aeschynomene indica*, *Cyperus michelianus*, *Limnophila erecta*, *Marsilea minuta*, *Hydrocera triflora*, and *Monochoria vaginalis*, several of which are highlighted by the IUCN as of conservation concern. Nepal's rice paddies span a wide elevational range – from the lowland Terai up to 3,000 m in the Himalayas, the latter being among the highest-altitude rice farms in the world. This environmental heterogeneity, coupled with mostly small-scale, rainfed farming, has allowed many native wetland species to persist in paddies. Even as agriculture modernizes, Nepal's scattered, family-run paddies remain refuges for diverse weed flora (Nowak et al., 2016).

In tropical Southeast Asia, rice weed communities are likewise species-rich. A geobotanical survey in southern Thailand recorded 104 weed species in paddies, including many rare or narrowly distributed plants (Nowak et al., 2015). Thailand's rice fields (≈11 million ha, ~40% of its cropland) are mostly rainfed and single-cropped, conditions that favor weed diversity by limiting continuous intensive management. Paddy fields' flora contributes considerably to biodiversity. Typical paddy species such as *Aeschynomene indica*, *Fimbristylis dichotoma*, *Hydrocera triflora, Lindernia ciliata, Oldenlandia verticillata, Monochoria vaginalis* and others are recognised as globally retreating due to farming intensification, appearing on red lists (albeit in the "Least Concern" category).

Fig. 12. Rice fields in the Rio Camana estuary near Camana, Peru. Photo. S. Nowak, 2024.

South Asian paddies thus function as important reservoirs for wetland flora. A similar richness of rice field flora has been found in Vietnam and the Philippines. Fried et al. (2021) found 117 species in paddy pools and 305 on bunds. They concluded that species richness depends mainly on climate and soil conditions as well as the proximity of non-paddy habitats. Researchers note that abandonment or extreme intensification of rice farming in Asia could cause many of these species to decline or vanish, mirroring patterns observed in Europe and North America, where agricultural change led to biodiversity loss (Japanese Red List 2014a, b).

The flora of paddy fields in South and Southeast Asia have already been directly influenced by the Green Revolution that began in the late 1960s. The spread of modern semi-dwarf varieties, the use of fertilisers and pesticides, and the expansion of irrigation systems increased yields, enabled multiple cropping, and also caused the displacement and disappearance of many valuable locally grown varieties (Pingali, 2012; Khoury et al., 2014). These shifts in cultivation practices, particularly intensification and herbicide-based weed management, have permanently altered the associated flora of paddy fields (Chauhan, 2012; Shekhawat et al., 2020). Therefore, documentation and conservation of Asian rice plant communities are urgent before habitat changes accelerate.

It is worth noting that certain Asian countries like China have enormous rice-growing areas with correspondingly high weed diversity, though detailed botanical surveys are few. In East and Southeast Asia, studies have found dozens of species per field, and a high beta-diversity (turnover of species) between regions. Preliminary investigations across countries such as Cambodia, Malaysia, Indonesia, Vietnam, and the Philippines suggest that each region harbours its own distinct set of paddy weed communities, many still undescribed in the literature. This indicates that the full spectrum of Asian rice field flora is far from completely known. Phytosociological research (vegetation classification) has classified many of these communities under the *Oryzetea sativae* class (the vegetation class specific to rice-field weeds, coined by Miyawaki in 1960). Within this class, several plant communities and associations have even been proposed recently (e.g., in Nepal and Thailand) to capture the unique species combinations found in local rice paddies. Such findings highlight the significant and specialised diversity of Asian rice weed flora and vegetation, which form the basis of many ecosystem services (Nowak et al., 2015, 2016; Settele J. et al., 2018; Fried et al., 2021).

West Africa

Africa's rice paddies host weed communities shaped by both indigenous flora and introduced Asian weeds. For example, in one survey alone, 171 plant species were recorded in rice paddies in Côte d'Ivoire (Kent et al., 2001). West Africa is home to its own domesticated rice (*Oryza glaberrima*) in addition to the widely grown Asian rice (*O. sativa*), and rice cultivation here dates back about 3,000 years (Choi et al., 2019). Surveys in West African lowlands have revealed weed flora that differs by ecological zone. Upland rice fields in forest zones were often invaded by the aggressive shrub *Chromolaena odorata* (a notorious neotropical invasive) among other weeds, whereas savanna upland fields had species like *Platosoma africanum* and *Mariscus cylindristachus* more characteristic of open grasslands (Kent et al., 2001). In flooded lowland paddies, however, both zones shared common aquatic weeds such as *Bacopa decumbens*, *Fimbristylis littoralis*, *Sphenoclea zeylanica*, and *Echinochloa colona*. Notably, sedges like *Cyperus difformis* and *Cyperus iria* were especially abundant in savanna-zone paddies. This indicates that West African rice weeds combine cosmopolitan paddy species (some of Asian origin) with local native plants adapted to African wetlands. Management intensity also matters: improved, irrigated rice schemes in Côte d'Ivoire had lower weed biomass and a somewhat different species

Fig. 13. Seasonally wet rice fields near Deepwater, north-eastern Australia. Photo. A. Nowak, 2023.

composition compared with unimproved traditional paddies, largely due to differences in water control. Overall, West African rice fields harbour a rich flora, but species dominance can shift with climate zone and farming practices.

East Africa

In East and Central Africa, where rice is a more recent crop, weed diversity can be very high as well. A comprehensive survey of seasonally flooded rice fields across Rwanda, Uganda, Kenya, and Tanzania recorded an astonishing 286 weed species from 59 families (Irakiza et al., 2021). This total included 42 species not previously documented as rice-field weeds in the region, reflecting how understudied these agroecosystems have been. Weeds in East African paddies ranged from cosmopolitan sedges and grasses to local wildflowers, with composition varying strongly by altitude. Low-altitude paddies were dominated by classic aquatic weeds like *Echinochloa colona*, *Cyperus difformis*, and *Cyperus esculentus*, whereas mid-altitude fields favored species like *Crassula granvikii*, *Pycreus lanceolatus*, *Ageratum conyzoides,* and high-altitude fields had *Leptochloa squarrosa*, *Sphaeranthus suaveolens*, etc. Despite this turnover, a core group of about 24 weed species was abundant across all elevations. The East African case confirms that rice paddies, even where introduced, can sustain a diverse flora blending widespread paddy weeds with regional natives. Such diversity also poses challenges for management, as evidenced by significant yield losses to weeds reported across Africa. Yet it also represents a trove of biodiversity in agricultural lands.

The Americas

Rice was introduced to the Americas relatively recently, between the 16th and 18th centuries, yet it quickly became an important crop in parts of South, Central, and North America. Because rice is non-native to the New World, many weed species in American rice fields were either introduced from the Old World alongside the crop or were native wetland plants that adapted to the paddies. Consequently, the weed

flora in American rice agroecosystems often reflects a mix of exotic and indigenous species, and tends to be slightly less diverse than that in long-established Asian or African paddies.

In the United States, a well-studied example comes from the Sacramento Valley of California. There, rice cultivation in the 20th century created vast surrogate wetlands in what was once natural marshland. Surveys of California's rice agroecosystem found about 62 vascular plant weed species, of which roughly one-third were alien (introduced) and two-thirds were native wetland plants (Barrett and Seaman, 1980). The dominance of native species is attributed to the similarity between flooded rice fields and the original Central Valley marshes they replaced. In essence, many native aquatic plants (e.g., *Bacopa* spp., *Sagittaria* spp.) simply colonized the artificial paddies, resulting in a weed flora that overlaps considerably with the regional pond flora. It is worth noting that the same grass tribe (*Oryzeae*) as *Oryza* also includes species of the genus *Zizania*, such as *Zizania palustris*, which have traditionally been used as food by the Indigenous communities of the Great Lakes region (Soreng et al., 2017; Hosterman et al., 2023). Although these species were not domesticated, studies have noted that some plant species that compete with and accompany *Zizania* are now found as weeds in modern rice fields (Ransom & Oelke, 1982; Barrett & Seaman, 1980). At the same time, numerous Old World paddy weeds have invaded California. Seventeen out of 20 recorded alien species in the rice fields were of Old World (Asian or Eurasian) origin. These include well-known rice weeds such as *Cyperus difformis*, *Echinochloa crus-galli*, *Scirpus mucronatus* (now *Schoenoplectiella mucronata*), *Monochoria vaginalis*, *Ottelia alismoides*, *Rotala indica*, and even wild rice (*Oryza rufipogon*). All are documented as common weeds in Asian paddies and were likely introduced to the Americas as contaminants in seed rice stocks. The small seeds, fast annual life cycle, and self-pollination of many of these weeds facilitate their spread and establishment in new regions (Barrett and Seaman, 1980). Thus, the American rice weed flora is an amalgam: Asian immigrants that came with rice cultivation now grow side by side with native marsh species that opportunistically thrive in rice fields.

Fig. 14. Ancient steep rice terraces near Bontoc, Luzon, Philippines. Photo. A. Nowak, 2014.

For instance, in California, the most abundant paddy weeds include *Ammannia coccinea* and *Bacopa rotundifolia*, both native North American wetland herbs, co-occurring with the cosmopolitan *Echinochloa crus-galli* complex. In South America, similar patterns occur. Historical accounts note that African rice (*O. glaberrima*) was brought to northeastern Brazil and the Carolinas (USA) via the transatlantic slave trade in the 1500s–1700s (Carney, 2004). Along with it came Old World weeds and the knowledge of rice farming. Over time, additional Asian rice varieties (*O. sativa*) became dominant in the Americas, bringing their associated weed flora. Today, major rice-growing areas in Latin America (such as the Southern Cone and the Guianas) report

Fig. 15 . Agri-cultural paddy landscape near Paang Kelot, Bali, Indonesia. Photo. A. Nowak, 2014.

weed spectra that include pantropical species like *Fimbristylis littoralis*, *Marsilea quadrifolia*, *Eclipta prostrata* or *Sphenoclea zeylanica*, many of which can trace their ancestry to Asia or Africa. At the same time, native American plants (for example, certain *Heteranthera* waterweeds, or *Luziola,* and *Leersia* grasses) have adapted to flood-irrigated fields and have become part of the paddy weed community.

In summary, compared to the Old World, New World rice paddies tend to have a higher proportion of introduced weeds but overall slightly lower species richness per field. Nevertheless, as California's case demonstrates, rice fields in the Americas can still host dozens of species and serve as secondary wetlands sustaining native flora (Barrett and Seaman, 1980).

Rice fields and adjacent natural habitats: vicarious species and replacement patterns

Rice paddies do not exist in isolation from their surrounding ecosystems. On the contrary, there is often a strong ecological linkage – and species overlap – between paddy weed communities and the flora of natural wetlands in the landscape, such as riverbanks, mudflats, and ponds. Ecologists refer to species vicarism or replacement when different habitats harbour analogous communities or species fulfilling similar roles. In the context of rice agroecosystems, many weed species are essentially wetland plants that have found a niche in cultivated fields. Adjacent natural habitats (e.g., muddy riverbanks or seasonally flooded pools) may host botanical

communities closely resembling those in rice fields, sometimes with vicarious species replacing each other across the natural–anthropogenic divide.

Rice field vegetation in the Old World has been classified into the class *Oryzetea sativae*, distinguishing the assemblages characteristic of paddies (Miyawaki, 1960; Nowak et al., 2013, 2015). Significantly, many of these plants are not exclusive to rice fields – they also occur in naturally wet, disturbed grounds like pond margins, ditches, or riverine mudflats throughout tropical Asia. Specific examples of vicarious occurrence abound. In Thailand, a *Nymphaea-do*minated plant community (*Nymphaeetum nouchali* association) was documented primarily in natural water bodies (ponds, ditches) but was occasionally also found in deeper sections of rice fields near Ayutthaya (Nowak et al., 2015). This community is characterised by the water lily *Nymphaea nouchali* and typically requires ~30 cm of water depth; in natural settings it flourishes in lakes or channels, yet, given the right conditions, it can temporarily establish within a flooded paddy. Conversely, some weed communities are mainly tied to rice fields but have close analogues in wild wetlands. For instance, the *Rotala rotundifolia*–dominated association (*Rotaletum rotundifoliae*) described in Nepalese paddies corresponds to vegetation of ephemeral mudflats (since *Rotala rotundifolia* and related species often occur on exposed muddy shores during drawdown periods). In Nepal's lowlands, this community was found in rice plots that dry out early, resembling the conditions of riverbank flats as the monsoon flood retreats (Nowak et al., 2016). Likewise, the *Ammannia pygmaea* association (A*mmanietum pygmeae*) in Nepal develops on wet, exposed mud in irrigated fields of river valleys, and shares species with natural pioneer vegetation on river margins (e.g., it includes *Ammannia pygmaea*, *Dichostylis micheliana*, *Callitriche palustris* var. *oryzetorum*, which are specialists of muddy wetlands). These *parallels* suggest that rice paddies often act as *surrogate habitats*, preserving plant assemblages that are ecologically equivalent to those on riverbanks and floodplains.

From a broader perspective, the introduction of rice farming into a landscape effectively creates a wetland patchwork that can either supplement or replace natural wetlands. In places where original wetlands have been lost or degraded, traditional rice fields can take over some of their ecological functions and species. A striking case is California's Central Valley: the conversion of vast marshes to rice agriculture has allowed a large fraction of the native wetland flora to survive within the fields (Barrett and Seaman, 1980). Researchers noted that the rice field weed flora in California is *unusual* among crop systems in that ~66% of its species are native, reflecting "the similarity in ecological conditions between rice fields and the original wetland habitats of the Central Valley

Fig. 16 . Rice cultivation requires an intense manual labour. Bali, Indonesia. Photo. A. Nowak, 2014.

that they replaced". In other words, many plant species simply shifted from natural marshes to the new paddy habitat, a direct replacement pattern. Similarly, in Japan and Korea, traditional rice paddies have long been known to support flora and fauna resembling natural marshes; the concept of *satoyama* landscapes in Japan includes rice fields as an integral semi-natural habitat for wetland biota. Conversely, in regions where wild wetlands remain abundant, one can observe an exchange of propagules between paddies and those wetlands. Rivers, for instance, can carry the seeds of paddy weeds downstream, establishing them on muddy banks, while floodwaters can introduce wild plant seeds into rice fields. This dynamic connectivity means that the composition of paddy weed communities can be influenced by nearby natural vegetation and vice versa (Osawa et al., 2020).

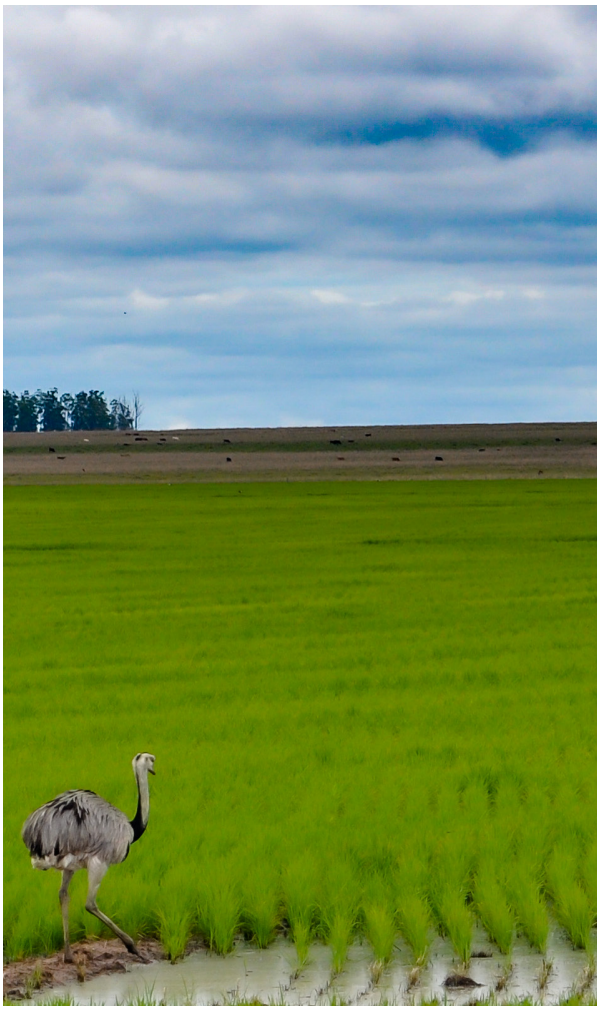


Fig. 17. The rice fields in northern Argentina are often home to a variety of bird species, such as the greater rhea (*Rhea americana*). Fot. A. Nowak, 2014

In syntaxonomic terms, some paddy weed communities straddle the boundary of anthropogenic and natural classification. In temperate Europe, the rice field vegetation (also placed in *Oryzetea sativae*) has been noted to share species with the *Bidentetea tripartitae* class – the class of nitrophilous mudflat pioneer vegetation. For example, Italian rice fields often contain *Bidentetea* species like *Bidens tripartita*, *Eclipta prostrata*, or *Lindernia dubia* alongside typical *Oryzetea* weeds (Vagge and Chiaffarelli, 2023). This indicates that the boundaries between paddy weed communities and natural wetland plant communities are porous. Rice fields, especially when managed in traditional or low-intensity ways, can be seen as extensions of the natural floodplain flora. They maintain many *vicariant species* – if a particular species is absent, a close relative or functionally similar species fills its role in the paddy versus the wild habitat. Such vicarism is evident, for instance, in the genus *Ludwigia*: in paddies in tropical Asia, *L. hyssopifolia* is common, whereas in the Americas, ecologically similar weedy water primroses (such as *Ludwigia decurrens* or *L. peploides*) may occupy wet field edges. While the exact species differ, their growth form and ecological niche are analogous.

The flora of rice paddies is closely connected to that of surrounding wetlands. Species composition can be viewed as a subset and reassembly of the regional wetland species pool, modified by agricultural disturbance. Rice agroecosystems often complement natural habitats by providing additional space for wetland plants, but in some cases they compensate for wetland loss by harbouring species that would otherwise disappear. Understanding these overlaps is important for conservation – it means that protecting rice paddies (or managing them wisely) can contribute to preserving regional wetland biodiversity. This

Fig. 18. An example of an Old World rice field near Kidundai, Tanzania. Photo. A. Nowak, 2023.

interesting phenomenon of species transition from natural habitats to anthropogenic ones, although fairly well understood for typical arable terrestrial crops, still requires further research for rice paddies.

Anthropogenic drivers and long-term co-evolution of weed flora in rice agroecosystems

The continuous cultivation of rice over centuries or even millennia has profoundly influenced the composition and biogeography of its associated weed flora. In regions of ancient rice agriculture, many weed species have co-evolved or co-migrated with the crop, leading to the emergence of what botanists sometimes call *archaeophyta anthropogena* – plant species that, though not originally native to a region, became established long ago through human agricultural activities and subsequent species adaptation to them. Rice paddies are a dominant agroecosystem in much of Asia, with a tradition of cultivation stretching back approximately 9,000 years. They have triggered plant adaptations and migrations since ancient times (Fornasiero et al., 2022). This group of species, which developed under the influence of centuries of regular human activity, is quite well known in ordinary farmland. Several well-known segetal weeds have recently become extinct across large parts of their ranges (e.g., *Cuscuta epilinum*, *Lolium remotum*). By contrast, comparable patterns of extinction or decline among paddy weeds are poorly documented, despite the long history of rice cultivation in Southeast Asia, dating back as far as cereal farming in the Fertile Crescent. Paddy fields also

harbour many micro- and cryptic taxa—in genera such as *Ammannia, Cyperus, Limnophila, Lindernia, Echinochloa, Eriocaulis, Fimbristylis, Hygrophila*, and *Marsilea*, whose traits may have shifted in response to the specific timing and hydrology of the paddy cycle. For numerous taxa, native ranges and original habitats are now difficult to reconstruct because these plants are tightly adapted to cultivation-related disturbances (e.g., tillage, herbicide regimes) and can withstand complete post-harvest drainage and ensuing dry periods.

We do not even know the exact history of most species found as weeds in rice cultivation. Such lists of archaeophytes (alien plants introduced and naturalised before c. 1500 CE) and kenophytes (those introduced and naturalised after 1500 CE) should be compiled for most areas of the world in order to apply conservation measures effectively. This is the case for archaeophytes (which are commonly protected as retreating species) and kenophytes (which are rather strong competitors and are removed) in standard crop weed communities (Nowak et al., 2018). Unfortunately, in the case of rice crop weeds, we are far from having a complete understanding of the history of the expansion of these species in anthropogenic habitats, which significantly hinders conservation efforts. Archaeophytes occurred in crop fields many decades (or even centuries) ago. Such plants can be considered ancient introductions to regions related to traditional cropping. In Europe, where rice was introduced around the Middle Ages (first in Spain and later Italy), certain rice-associated weeds that arrived early on could be regarded as archaeophytes in the Mediterranean. For instance, *Echinochloa crus-galli* was noted in southern Europe by the 15th century (Sharma, 1957). More recent invaders (such as *Heteranthera limosa* in Italy or *Ludwigia grandiflora* in France) are also seen as typical neophytes, indicating post-1500 AD introductions. The distinction blurs in rice

Fig. 19 A rice field in Peru, almost ready for harvest. Photo. A. Nowak, 2024.

agroecosystems because the continuous import of rice germplasm has been a vector for plant introduction since the crop's earliest spread.

Another phenomenon under long-term cultivation is the development of weedy rice – aggressive, uncultivated forms of rice that infest fields. These are essentially conspecific or closely related to the crop itself. In Asia, weedy rice usually refers to feral forms of *Oryza sativa* (often called "red rice" due to pigmented grains) that have evolved to shatter seeds and persist in fields, mimicking wild traits. These weedy rices likely evolved as a by-product of millennia of rice farming, through processes of de-domestication and hybridization with wild relatives (Wu et al., 2022). In Africa, an analogous situation has historically been observed: the native African rice (*O. glaberrima*) has been plagued by weedy forms and hybrids with the wild *Oryza barthii*. These African weedy rices have distinct genetic lineages, but similarly compete with the crop and reduce yields (Kehinde et al., 2024). Thus, continuous rice cultivation has even given rise to "weed" versions of rice itself – a taxonomically significant outcome in which the crop's gene pool spills into the feral weed pool. This complicates weed management but also illustrates how tightly linked the crop and its weed flora have become over time. Another example is phenomenon that has a direct impact on crop-associated vegetation, known as Vavilovian mimicry. This is a form of mimicry in plants in which weeds evolve to acquire traits typical of cultivated plants through generations of unconscious selection during manual weeding. In rice agroecosystems, classic examples include *Echinochloa oryzoides* in Mediterranean systems and the related *E. oryzicola* in East Asia, whose seedlings and phenology closely resemble those of rice, helping them escape detection during manual weeding (Barrett, 1983; Hoste & Verloove, 2022).

Long-term rice agriculture also exerts selective pressures that shape weed community traits. For example, paddy weeds tend to evolve short life cycles synchronized with the crop season and adaptations to flooding or waterlogged soils (such as aerenchyma in roots or seed dormancy to survive flooding). Frequent flooding and drainage cycles in traditional paddies strongly filter which species can thrive. Indeed, research indicates that the main cause of decreasing species richness in rice weed communities is the frequent and drastic changes in water regimes (Nowak et al., 2015). Species that could not adapt have been eliminated over time, while those tolerant of submergence or rapid drying have became dominant. Weeds like *Fimbristylis miliacea* (a mud sedge) or *Marsilea* (an aquatic fern) produce seeds or spores that withstand inundation and then germinate when fields dry, perfectly timed with rice phenology.

The legacy of long-term cultivation is also evident in the regional distinctiveness of rice weed floras. Asia, being the cradle of rice domestication, has an extremely rich "species pool" of potential paddy weeds – essentially a reservoir of wetland species that have had thousands of years to encounter rice fields and enter the agroecosystem. This partly explains why surveys in biodiversity hotspots like Nepal or the Philippines find more than 80 or even 100 species in rice fields within relatively small areas and during short-term surveys of a single rice-field type (Nowak et al., 2016; Fried et al., 2021). By contrast, regions with a shorter history of rice farming (e.g., Europe or North America) have fewer specialised paddy weeds and rely more on introduced species from Asia and Africa or on native generalists. Over centuries, we may expect some convergence – for instance, some New World native plants might undergo adaptation to behave more like "rice weeds." There is evidence that continuous cropping of rice in the Americas is selecting for native species that mimic the life cycle of the crop. Likewise, certain Old World weeds have now been present in the Americas for over 100 years (e.g., *Monochoria vaginalis* in California since the early 20th century) and are evolving within their new habitats. The long chronicle of rice cultivation has created a cosmopolitan yet

locally adapted weed flora. Ancient human-mediated dispersal led to the establishment of *archaeophytic* weeds in tandem with rice's expansion. Some weeds co-evolved to the point of becoming nearly as "domesticated" in their dependence on rice fields as the crop itself (often termed *segetal* species). Meanwhile, the evolutionary pressure of flooded agriculture produced weed populations with specialised traits (e.g., cleistogamous flowers underwater in species like *Monochoria* and *Rotala*, which enhance seed set in submerged conditions) (Barrett and Seaman, 1980). Understanding this evolutionary interplay is key to managing weeds and conserving their diversity, as these plants are living relics of agricultural history and ecological adaptation.

Biogeographical contrasts: old world vs. new world weed communities

The composition of rice paddy weed communities shows clear biogeographical patterns when comparing the Old World (Asia and Africa) to the New World (Americas). These differences stem from historical, evolutionary, and ecological factors.

In the Old World, rice paddies have existed for millennia (ca. 9,000 years) and thus their weed floras are largely drawn from native regional species that have long adapted to paddy conditions. Asia's paddy weeds, for example, include many indigenous taxa (from families such as *Cyperaceae*, *Onagraceae*, *Scrophulariaceae*, etc.) that were present in the natural wetlands of the region and gradually became associated with rice agriculture. Africa, with its own independent rice tradition in West Africa, similarly has many native aquatic plants that occur in traditional paddies. Because of this deep-time association, Old World paddies often harbour endemic or region-specific weeds. For instance, South Asian paddies have species such as *Hydrolea zeylanica* or *Diplazium esculentum* (an edible fern) that are essentially confined to that part of the world. Southeast Asian paddies might have *Melochia corchorifolia* (a tropical weed) or *Leersia hexandra* (swamp ricegrass), which are less common elsewhere. African paddies contain unique natives such as *Nymphaea maculata* (a water lily) or *Ottelia ulvifolia*, seen only in African wetland rice habitats. Moreover, in the Old World, the weed communities show a high degree of differentiation by region (high beta-diversity) – as noted earlier, countries across Asia can have quite distinct weed associations (Nowak et al., 2015, 2016). This suggests that, over evolutionary time, local weed floras have specialised alongside local rice farming practices.

By contrast, in the Americas rice was introduced without a long-standing, paddy-associated weed flora. The communities observed today assembled after introduction. Much of that assembly entailed importing Old World weeds. Consequently, New World weed communities tend to be more homogenised and composed of cosmopolitan species. A rice field in Texas, one in Cuba, and one in Brazil may share many of the same weed species – often pantropical ones – because the introduction process was similar. For example, *Echinochloa crus-galli*, *Cyperus iria*, *Ludwigia octovalvis*, *Marsilea quadrifolia* (all of Old World origin) can be found across rice fields in the Western Hemisphere. There are fewer truly *endemic* or region-specific paddy weeds in the Americas, since rice agriculture there is only a few hundred years old and mainly built on borrowed flora. New World paddies also recruit local native species, but these tend to be broadly distributed wetland or even ruderal plants rather than narrow endemics. In the California study, two-thirds of the weeds were native, but they were generalist natives from wetlands (many widespread across North America; Barrett and Seaman, 1980). Similarly, in South America, native entrants such as *Sagittaria montevidensis* (an aquatic plant native to the Americas)

Fig. 20. Rice fields near Paranga, central Tanzania. Photo. S. Nowak, 2023

have become common weeds in rice fields from Argentina to the southern US. These natives often have wide ranges to begin with, indicating a lower regional differentiation compared to Asia's patchy weed distributions.

Another contrast lies in species richness and community complexity. Old World rice fields, especially in tropical Asia and parts of Africa, often support a greater number of species per unit area than New World fields. A tropical climate, year-round growing seasons, and the long evolutionary history all contribute to this richness. For example, a single 1 m^2 quadrat in a South Asian traditional paddy might contain up to 45 weed species (mix of grasses, sedges, broad-leaved aquatics), whereas a similar quadrat in a mechanised US rice field might contain just a handful (often dominated by 2–3 main weeds). This is not a strict rule – exceptions exist – but as a trend, Old World paddies exhibit higher within-field diversity. The East African survey (286 species across sites) and Thai/Nepal studies (80–100+ species in one season and small area) illustrate how rich those floras can be (Nowak et al., 2015, 2016; Irakiza et al., 2021). In contrast, the California flora totaled 62 species statewide (Barrett and Seaman, 1980), and other US studies report on the order of 30–50 weeds in regional lists. A likely reason is the continuous hand-weeding and varied microhabitats in traditional paddies, which allow many minor species to coexist, versus more uniform, chemical-managed fields in the Americas where a few hardy weeds dominate.

Furthermore, life-form composition of rice paddies' weed vegetation can differ. Asian paddies often harbour delicate annual broad-leaf herbs (e.g., *Lindernia*, *Rotala*, *Marsilea*), floating aquatics (*Azolla, Spirodela* ferns and duckweeds), and emergent sedges in a complex mosaic. American paddies, especially in temperate zones, show greater prevalence of robust grasses (like *Echinochloa*, *Leptochloa*) and

fewer floating species (since fields are often drained earlier and the climate may not suit tropical floaters). An interesting biogeographical note is that some genera have complementary species in Old vs New Worlds: *Fimbristylis miliacea* (a sedge) is a notorious Asian rice weed, whereas its ecological counterpart in the Americas might be *Fimbristylis littoralis* (also present in Asia but more dominant in Africa/Americas). The Old World *Ludwigia hyssopifolia* (water primrose) is paralleled by the New World *Ludwigia peploides/decurrens* complex. And where Asian paddies have *Monochoria vaginalis*, American paddies have *Heteranthera limosa* (commonly called ducksalad) occupying a similar niche to an amphibious *Pontederia*. These pairs exemplify the vicarious distribution of related taxa between hemispheres. The differences in the species composition of rice-field weeds between the Old and New Worlds directly influence the scope and nature of the useful potential of the weed flora. The species that are characteristic of a given region determine which plants are available as resources for local communities, thereby influencing the diversity and nature of traditional uses. In areas with a longer history of rice cultivation and a richer, more stable weed flora, the range of ethnobotanical knowledge tends to be broader and more deeply rooted. In summary, the Old World vs. New World comparison highlights the imprint of history. The former's weed communities are older, more diverse, and more regionally unique, while the latter's are newer, somewhat less diverse, and composed of a cosmopolitan mix of immigrants and adaptable natives. These differences are further reflected in the scope of traditional knowledge related to rice-field management.

Fig. 21 Rice fields in Sumatra used as pasture for water buffalo after the harvest. Photo. A. Nowak, 2015.

Weed flora in Asian vs. African rice systems (*Oryza sativa* vs. *Oryza glaberrima*)

Rice paddies worldwide predominantly cultivate Asian rice (*Oryza sativa*), but in parts of West Africa, the traditional African rice (*Oryza glaberrima*) and its wild relatives have also been important. The two rice species differ in their agronomic traits and history, which in turn influence their weed floras. It is highly likely that humans have independently domesticated two different rice species. African rice is very genetically similar to wild African rice (*O. barthii*), just as Asian rice (*O. sativa*) is to wild Asian rice (*O. rufipogon*), and these two divisions have wide genetic differences between them.

African rice (*O. glaberrima*) is known for its luxuriant growth habit – it tends to be taller with profuse vegetative branching. This trait allows it to smother weeds more effectively by shading the ground (Montcho et al., 2013). Indeed, traditional African rice varieties often grow in less intensely managed fields (rainfed or wild floodplains) and rely on their competitive ability against weeds. As a result, fields of African rice historically may have somewhat lower weed biomass or at least different weed composition, skewed towards shade-tolerant species. By contrast, Asian rice (*O. sativa),* especially modern varieties, is often shorter and has a more erect growth. Weeds in *O. sativa* fields can receive more light and thus flourish unless actively controlled by farmers. This may partially explain why West African farmers valued African rice for its ability to thrive with minimal weeding – its dense canopy suppresses many competitors. However, African rice's weed-smothering trait comes with trade-offs: the crop itself yields less and can lodge (fall over) due to its taller, weaker stems (Sarla and Mallikarjuna Swamy, 2005; Chen et al., 2019). In recent times, many African paddies have switched to Asian rice varieties to increase yields, which might inadvertently increase the need for weed control since the new varieties do not cover the soil as completely.

Fig. 22. Species-rich rice vegetation near Matara, Sri Lanka. Photo. A. Nowak, 2016.

The weed communities in ancient African rice systems (before Asian rice was introduced) would have been drawn entirely from the native African wetland flora. These likely included wild grasses like *Oryza barthii* (the wild progenitor of African rice), which could act as a weed in fields, as well as various sedges and aquatics native to African swamps (e.g., *Bolboschoenus glaucus*, *Nymphaea* spp., *Utricularia* sp. in flooded zones, and *Commelina* spp. or *Mitracarpus* spp. on moist soil). African rice domestication occurred in the inland delta of the Niger River, a region with rich wetland biodiversity. Thus, one might imagine the original African rice paddies had a weed flora overlapping significantly

with these natural floodplains. For example, early European observers in the 1500s described West African rice fields as looking like "ponds" with abundant aquatic vegetation (de Zurara, 1841). The wild *O. barthii* itself was a notable component – it grows aggressively and can hybridise with *O. glaberrima*, producing intermediate weedy forms (Linares, 2002). These weedy hybrid rices were a unique challenge in African systems, analogous to (but genetically distinct from) the weedy "red rice" problem in Asia.

When Asian rice (*O. sativa*) was later introduced to Africa (starting around the eighteenth century and increasing through colonial times; Linares, 2002), it also brought along some Asian weeds and gradually replaced African rice in many areas. Consequently, today many African paddies (especially in East Africa or international projects in West Africa) host weeds that are common in Asia – for instance, *Echinochloa crus-galli*, *Leptochloa chinensis*, *Sphenoclea zeylanica*, *Ludwigia adscendens*, etc., which were not part of the native flora. This means contemporary African rice fields can have a two-layered weed flora: a remnant native set from the old African rice tradition and an introduced set accompanying Asian rice. In pure *O. glaberrima* cultivation (which still persists in some isolated pockets), one might find relatively more of the native set. Interestingly, breeding programmes (e.g., NERICA – New Rice for Africa) have crossed Asian and African rice to combine traits, including weed competitiveness (Somado et al., 2008). These new varieties could change weed dynamics by altering planting patterns or growth habits.

Some weeds may show clear preferences for one system or the other. For example, *Striga* spp. (parasitic witchweeds) are serious pests in upland African rice; *O. glaberrima* has some tolerance to *Striga*, whereas *O. sativa* is highly susceptible (Sarla and Mallikarjuna Swamy, 2005; Montcho et al., 2013). Thus, *Striga* might historically be considered part of the "weed" complex in African traditional rice (particularly upland fields), but it is absent in Asian wetland paddies. Conversely, the aquatic fern *Azolla* (often intentionally introduced as biofertiliser in Asian paddies) would have been missing in African systems until recent times. Likewise, *Monochoria vaginalis* is a quintessential Asian paddy weed (and medicinal plant; Zheng et al., 2013a; US Fish and Wildlife Service, 2021), but in Africa it appeared only after introduction and is not widespread. Instead, African paddies had native water lilies and *Ammannia* species occupying similar niches. Another example is the cyanobacterial symbiont *Anabaena*. Asian farmers utilised *Azolla-Anabaena* in paddies, whereas African rice systems traditionally did not, affecting the weed-algae interplay.

Weedy rice forms differ too. In Asian *O. sativa* fields, weedy rice is typically feral *sativa* that sheds seeds before harvest. In African *O. glaberrima* fields, the weedy rice was often *O. barthii* or *glaberrima–barthii* hybrids. These have different seed characteristics and dormancy. A practical upshot is that the methods to control weedy rice might differ – African farmers historically saw weedy *barthii* as both a nuisance and a genetic reservoir, sometimes even tolerating a little of it because it could reseed the field naturally if managed. Asian farmers, by contrast, developed refined methods, such as roguing out (removing off-type plants by hand before those plants set seed) and manipulating water depth to suppress weedy rice germination. Thus, the flora associated with *Oryza sativa* vs *O. glaberrima* reflects each crop's biology and history of cultivation. *O. glaberrima*'s paddies are very distinct, with robust crop stands that suppress all but the hardiest native wetland weeds. *O. sativa* paddies, in their Asian heartland, fostered a dazzling variety of weeds but required intensive human intervention to keep those weeds in check (hand-weeding, water manipulation, etc.). Where the two traditions meet – as in modern Africa – one can observe an interesting blend: the aggressive weedy species of Asia mixing with the resilient natives of Africa. For weed scientists and ecologists, this provides a natural experiment in how crop choice and agronomy drive weed community structure and composition. For ethnobotanists, this agronomy-based structure and composition become

the foundation for a specific set of traditions related to weed-flora management. The above comparison shows that African systems are characterised by tuberous weeds, such as *Bolboschoenus glaucus* or *Nymphaea* which can be used as an emergency food source. They are also a rich source of traditionally used herbal medicines, such as *Commelina*, *Mitracarpus*, *Utricularia* and *Ammannia*. In contrast, Asian systems are distinguished by a greater abundance of weeds that function as leafy vegetables. Examples include *Echinochloa*, *Ludwigia*, *Monochoria* and *Sphenoclea*, which provide food on a seasonal basis. Unfortunately, these topics still seem unexplored and require intensive field research.

Conservation value and threats to weed diversity

Although often overlooked, the weedy vegetation of rice paddies has significant conservation value. As we have seen, rice fields can function as refugia for wetland plant species, including some that are rare or declining in natural habitats. Several paddy weeds are listed on regional or global coffnservation lists. For example, in South Asia a number of characteristic rice-field plants (*Ammannia*, *Aeschynomene*, *Hydrocera*, *Lindernia*, etc.) appear on the IUCN Red List (mostly as Least Concern, but their listing highlights their rarity or restricted range; Nowak et al., 2013, 2015, 2016, 2020). These species find perhaps their last abundant strongholds in traditional rice agroecosystems. In Mediterranean Europe, the *Oryzetea sativae* class is considered of high conservation interest because it includes many species that have become rare with the decline of traditional agriculture – such as *Pulicaria vulgaris* or *Lythrum hyssopifolia*, small annual wetland herbs that were formerly common in paddies and riverbanks but

Fig. 23. Rice fields in Batang Angkola River valley, near Aekbadak, Sumatra, Indonesia. A. Nowak, 2014

Fig. 24. Rice fields on flatlands around Mt. Kilimanjaro near Kahe, Tanzania. Photo. A. Nowak, 2023

are now endangered in some countries. In Japan, the decline of extensive wet-rice cultivation in certain areas has been linked to the loss of habitat for aquatic plants and amphibians; consequently, programmes exist to preserve *satoyama* rice paddy landscapes for their biodiversity. Even in highly developed agricultural zones like California, rice fields are recognised as surrogate wetlands essential for migratory waterfowl and also for conserving native flora (e.g., the endemic *Downingia* wildflowers flourish in some rice fallows, and vernal pool plants can persist along rice levees; Barbour et al., 2005).

The weed diversity in rice paddies is under various threats. The primary threat is the intensification of agriculture. Modern high-input farming tends to homogenise and simplify agroecosystems. In rice cultivation, intensification comes in forms such as increased use of herbicides, improved seed cleaning (reducing weed seed contamination), planting of short-duration or multiple crops per year (leaving less fallow time for weeds), laser levelling and deep-water management (drowning terrestrial weeds), and even shifting to direct seeding with pre-emergence herbicides. These practices, while boosting yield, drastically reduce weed abundance and richness. Studies have documented that intensification leads to precipitous declines in paddy plant diversity (e.g., Nowak et al., 2014). For example, in Japan and Europe, the abandonment of marginal paddies in hilly areas (due to low profitability) or conversely the adoption of herbicide-heavy regimes in lowlands has caused many formerly common segetal (field) weeds to disappear (Nowak and Nowak 2013; Nowak et al., 2014). A Finnish study (Hyvönen and Salonen, 2002) and a UK study (Robinson and Sutherland, 2002) are often cited in this context, showing that both abandonment and intensification can reduce arable weed diversity by creating either unsuitable conditions or outright eradication. Analogous trends are now observed in rice fields

globally. If a paddy is kept in production but with heavy chemical and water control inputs, it may become a near-monoculture of rice with only a few hardy weed survivors (like *Echinochloa* or *Cyperus* which can develop herbicide resistance). If a paddy is abandoned (left dry or converted to other crops), the specialised aquatic weed community is lost and replaced by upland weeds or scrub.

Another threat is habitat loss: as urbanisation or other land-use changes encroach, many traditional rice fields are simply disappearing. In East Asia, rapid urban expansion has consumed paddy land, and with it the unique biota. Additionally, the push for higher food production is leading to consolidation of fields and a shift to more industrial rice farming. In such consolidated systems, the diverse mosaic of micro-habitats (shallow corners, weedy bunds, periodic fallows) is eliminated.

Invasive species pose a more recent threat in some regions. While paddies themselves harbour invasive weeds (like *Mimosa diplotricha* invading some Asian paddies, or *Salvinia molesta* ferns blanketing African paddies), these invasives often outcompete native weed flora, reducing diversity. The use of invasive alien fish (such as herbivorous carp in integrated farming) can also impact weed flora by feeding on certain aquatic plants.

The decline of weed diversity is not just an ecological loss. It can mean loss of ecosystem services (pollinator support, soil health, genetic resources) and cultural resources (medicinal plants, wild foods). Recognising this, some conservationists advocate for the concept of "biodiversity-friendly rice". This includes maintaining small refuges of weeds at field margins or timing field operations to allow a flush of native flora after harvest. In Europe, agri-environment schemes have been trialled where farmers are compensated for late flooding of fields post-harvest to create wetland habitat for birds and simultaneously allow moist-soil plants (many of which are paddy weeds) to germinate (Marty, 2017). In Asia, certain traditional practices like alternating rice with a fallow or a low-input rotation crop can give respite to weed communities. For example, in northern Iran, rotating rice with dryland crops led to a resurgence of some segetal weeds when rice was replanted, compared to continuous double-cropped rice which suppressed most weeds (Ashouri et al., 2022).

Conservation of rice weed flora may also involve *ex situ* measures, such as seed banks for rare arable weeds. Documenting the vegetation (as the authors of this book are doing) is a crucial step – many weed communities have yet to be formally described, especially in tropical countries. By classifying this vegetation, researchers draw attention to its diversity and conservation state, which can help spur protective measures. Furthermore, by documenting traditions related to the use of classified rice field

Fig. 25. Terraced rice fields in Chico River Valley near Bugnay, Philippines. Photo. A. Nowak, 2014

flora, we are able to highlight its importance for local communities, which may simultaneously contribute to its protection at the local level (Wall et al., 2025).

Rice paddies, often seen merely as food production systems, harbour a wealth of plant diversity that has ecological, genetic, and cultural value. This weed flora is at risk from modern agricultural intensification and land-use change. Preserving it will require conscious efforts to balance productivity with ecological stewardship. The following chapters of this book will delve deeper into specific taxonomic groups, but this introductory overview makes clear that the flora of rice paddies is an integral part of our wetland biodiversity and cultural heritage – one that merits both study and conservation action (Nowak et al., 2014, 2015, 2016). Although many species in rice-field areas are native, most irrigated rice systems were created by transforming natural wetlands and coastal habitats (Yoon, 2009; Reis et al., 2017). Many rice-terrace systems in tropical Southeast Asia were established on previously forested hillsides. Holocene pollen records from southern China and tropical Southeast Asia indicate that the expansion of intensive rice cultivation over the past two millennia coincided with widespread deforestation and declines in tree-species diversity in cultivated areas. This pattern is corroborated by archaeological work on the Ifugao terraces, which documents terrace construction following deforestation and a shift from field-based to terrace-based rice cultivation (Zheng et al., 2021; Acabado, 2012). According to estimates, rice fields currently account for about 15–18% of the world's wetland area (Lawler, 2001; Elphick, 2010). Most of the botanical richness of rice-field landscapes is concentrated in small patches—particularly linear features such as embankments and field margins. These features are the most valuable areas for maintaining the persistence of native wetland plant populations (Fried et al., 2018; Fried et al., 2021). The consolidation and intensification of cultivation are associated with further reductions in the species diversity of these communities (e.g., field enlargement, increased herbicide use) (Osawa et al., 2020). Therefore, although rice-field landscapes can complement regional biodiversity, they are unable to restore the composition of native wetland flora without targeted restoration of natural wetlands .

Traditional knowledge and the hidden value of rice weeds

For nearly nine thousand years, weeds in rice fields have had direct and daily contact with humans, remaining constant companions in the agricultural landscape. These species are not merely a nuisance to agriculture – they have been observed, studied and evaluated by generations of farmers, usually outside

Fig. 26. A rice farmer in Bali, Indonesia. Photo. A. Nowak, 2014.

the scope of formal science. Thanks to this practical knowledge gained in the field, people have discovered an extraordinary range of useful properties of weeds found in rice fields: including uses as food, fodder, medicine, materials, and elements of rituals or beliefs.

Over countless agricultural cycles, the most valuable properties of these plants have been preserved and passed on through traditional knowledge. In many rice-growing cultures, the accumulated knowledge about weed species is exceptionally rich, sometimes surpassing the information available in the scientific literature. Despite their importance, rice weeds remain largely overlooked in mainstream botanical and agricultural research.

Traditional knowledge related to rice cultivation and associated species is not homogeneous. Ancient traditions originating in the Asian cradle of rice cultivation contrast sharply with the still evolving traditions of the Americas. This knowledge also changes over time.

The new needs of constantly developing societies are influencing the discovery of new benefits from rice field ecosystems. An example comes from the aquarium industry. Besides some aquatic organisms, several plants widely sold as aquarium ornamentals are long-recognized weeds of rice fields, for example Hygrophila polysperma, *Limnophila sessiliflora* and *Rotala rotundifolia*. These plants are harvested or cultivated within rice-growing landscapes (Mukherjee, 2011; Flora of North America, 2020). The multitude of cultivation techniques, the diversity of topographical, hydrological and climatic conditions, and the proximity of specific ecosystems, all of which influence the species composition of rice fields, also influence the scope of local knowledge about them. Nevertheless, traditional knowledge based on plants in close proximity to humans remains a valuable source of research hypotheses. In times of accelerating biodiversity loss, intensification of agriculture, climate change and erosion of local traditions, the need to document and appreciate knowledge about weeds found in rice fields is an imperative. As weeds decline due to intensification, communities can lose important resources (medicinal plants, wild vegetables). Thus, documenting ethnobotanical uses of rice weeds has an important conservation aspect. In this study, we hope to provide a more complete understanding of the role played by weeds found in rice fields – not only in agroecosystems, but also in the material and spiritual life of rice-growing societies. Ultimately, this work aims to support environmental protection, sustainable agriculture, food security, and the preservation of our shared biocultural heritage. This perspective reinforces the idea that maintaining a degree of weed diversity in paddies can have co-benefits for rural livelihoods, beyond the ecological benefits (Pani et al., 2002; Arunesh et al., 2018).

Fig. 27. An anonymous research assistant with *Eriocaulon cinereum*, near Krâchéh, Cambodia. Photo. A. Nowak, 2014.

Fig. 28. Cooperation with rice field workers to have protection from the hot midday sun. Nepal. Photo. G. Kusza, 2013.

Methods:

Field research

This book is the result of floristic and phytosociological survey conducted in regions of traditional rice cultivation. The research covered countries in Africa (Tanzania, Uganda, Egypt, Tunisia), Asia (Tajikistan, Iran, Kyrgyzstan, Thailand, Nepal, Sri Lanka, Malesia, Indonesia, Cambodia, Philippines, Japan, South Korea, China), the Americas (Peru, Mexico, Brazil, Argentina) and Australia. The geobotanical work carried out covered the full spectrum of rice field habitats – permanently flooded paddies, shallowly inundated mud, littoral puddles, and field margins and embankments. The aim was to capture plant communities associated with different types of rice fields, characterised by varying cultivation intensity (Nowak et al., 2013; 2015; 2016).

The rice field areas were inventoried for all vascular plants. The size of the plots was adjusted to the structure and diversity of the habitat, ranging from 3 to 25 m^2. All samplings were conducted during the rice-growing season. This ensured that surveys coincided with peak development of vegetation accompanying rice cultivation and preceded the period of intensive weeding and harvesting (Nowak et al., 2013, 2015, 2016).

When possible, plant species were identified in the field. In cases of identification difficulties, herbarium samples were collected for further analysis using appropriate keys and optical equipment. The taxonomic nomenclature was standardised using the Taxonomic Name Resolution Service (TNRS), version 5.1 (Boyle et al., 2021). Herbarium specimens of representative weeds were deposited in the OPUN herbarium (University of Opole, Poland). Each species was subject to photographic documentation, which is presented in this study (e.g. Nowak et al., 2016).

Literature synthesis

The species identified in the field were used as reference points for compiling literature on the traditional uses of plants associated with rice cultivation. The literature included in this volume comprises 1002 publications from 1025 to 2025 CE. The analysed works were written in 16 languages: English, French, Spanish, Portuguese, Indonesian/Malay, Polish, Chinese, Turkish, Vietnamese, German, Farsi, Arabic, Dutch, Latin, Japanese and Romanian. The ethnobotanical information contained in these publications covers 91 countries (Figs. 1 and 2). The overall scope of the data used is presented in the charts below.

The main full-text search for traditional uses of rice-field plants was conducted using the resources of the main author's private ethnobotanical library. The scanned book literature was processed into OCR data using ABBYY FineReader 16 and indexed using DocFetcher 1.1.25 to enable multilingual keyword searches in PDF/DOC files. Missing information was obtained from the following libraries and repositories:

— Scholar

Google Scholar; JSTOR; CEEOL; Academia.edu; CrossAsia; Digital Public Library of America; Europeana; Artstor; Google Books; Project Gutenberg; Internet Archive; HathiTrust; Digital Library of the Caribbean; Dutch Caribbean Digital Platform; Digital Library of Dutch Literature; CSUCA Catalog; UDUAL Library; NLP Research Portal; eVifa Digital Library.

— National & university libraries

Federacja Bibliotek Cyfrowych; Polish National Library; Cambridge Digital Library; Wellcome Collection; Harvard Library Digital Collections; New York Public Library Digital Collections; Stanford Digital Collections; Princeton University Library; Duke University Library; UCLA Library; UMSA

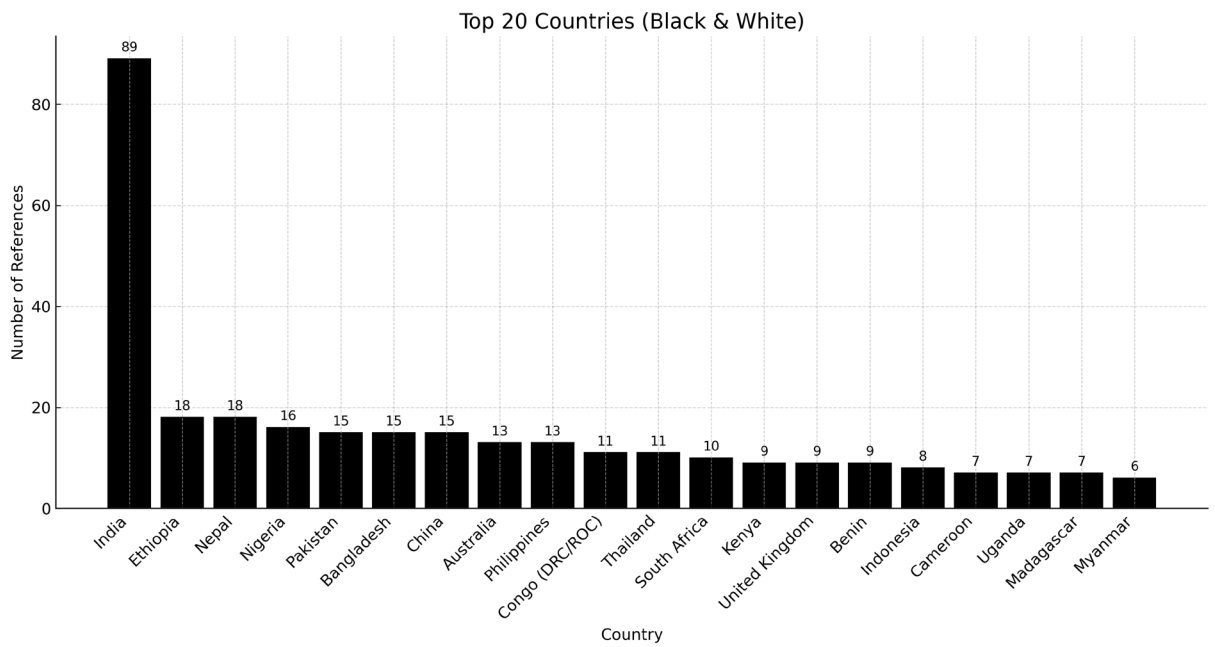


Fig. 29 Countries with the highest number of references in literature.

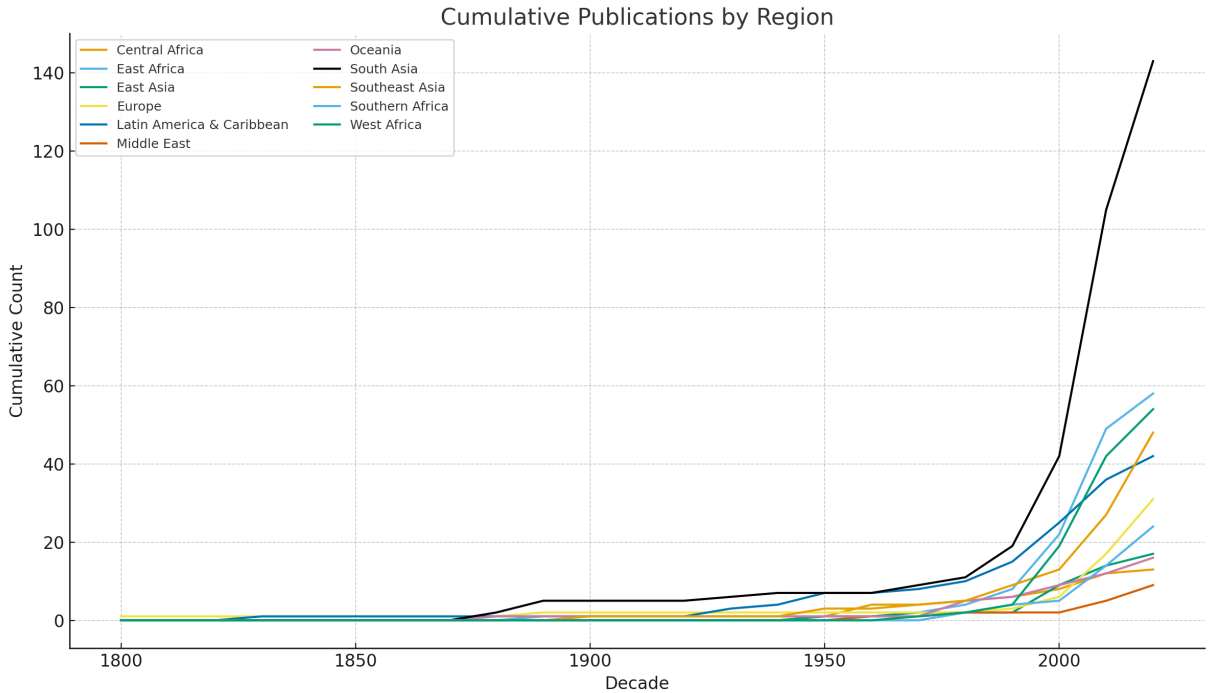


Fig. 30 Cumulative contribution of individual regions since 1900.

Library; ABNB Library; Library of Congress; Gallica/BnF; Spanish National Library; Russian National Electronic Library; Yeltsin Presidential Library; National Library of China; Taiwan NLPI; Tokyo Digital Archive; Tibetan Library Archive; Peruvian Culture Repository.

— Specific resources

Traditional Knowledge Digital Library; EthMed Database; Medicinal Plant Names Services; Biodiversity Heritage Library; Cuneiform Digital Library; Digital Silk Road; Flora of Taiwan; Japanese Ethnobotany.

The search in the above repositories was conducted using current and historical scientific names of plants and vernacular names of each species in combination with terms relating to their use. All searches were adapter to working languages. No filters were applied for date or language.

Where available, we extracted the common name of the taxon and its uses from each source included, along with the method of preparation, the part of the plant used, and the cultural context. In addition, we extracted information from laboratory phytochemical studies to relate chemical composition and properties to traditional uses. Local names were listed following the source material. In cases of obvious synonyms or spelling variants, the standard form was indicated. Common names were provided in their original languages and, where available, with diacritical characters.

Ethics and disclaimers

This work is a compilation of previous field observations and an in-depth analysis of the literature. It does not include any new interactions with participants or communities. Information on medicinal properties has been recorded for documentation purposes and is not meant to be medical advice.

Fig. 31. Rice paddies after the harvest, before the winter crop is sown. Luzon, Philippines. Photo. A. Nowak, 2014.

Catalogue of rice paddy plant species

Abutilon angulatum (Guill. and Perr.) Mast.

Family:
Malvaceae Juss.

Synonym:
Bastardia angulata Guill. and Perr., *Abutilon intermedium* Hochst. ex Garcke

Vernacular names:
Ethiopia (Amharic): Nechlo; **Ethiopia** (Kwego): Gompolto; **International** (English): elephant's ear, fluted abutilon; **Madagascar** (Malagasy): Hafopotsy; **Mali** (Dogon): pédu namu; **Mozambique** (Manica)**:** guenderi; **Mozambique** (Maputo): licupecupe; **Mozambique** (Tete): varvura; **Namibia** (Kwanyama): ehati, omahati; **Nigeria** (Yoruba): Ifin funfun; **Rwanda** (Kinyarwanda): umushoshwe, umuhatura; **Senegal** (Fula-Pulaar): danéhi; **Senegal** (Ndut): burgoñ; **Senegal** (Wolof): vehndiay; **Tanzania** (Fipa): Fyefye, Fyofyokoe, Nyalufungulo, Nyamabumu; **Tanzania** (Shambaa): Fiefie; **Zambia** (Gwembe Valley): mukokom-wamomba; **Zambia** (Swahili): Nyangamizi

Conservation value: –

Distribution:
The native range of this species is tropical Africa. *Abutilon angulatum* occurs widespread in the drier parts of tropical Africa from Senegal, The Gambia and Mali eastwards to Eritrea, Ethiopia and Somalia, and southwards to Namibia, Botswana, Zimbabwe, Mozambique and South Africa. It also occurs in Madagascar (POWO, 2025).

Habitat:
Abutilon angulatum is widespread in wooded savannahs, open forests, thickets, and grassy savannahs. It is also found in croplands, fallow fields, and disturbed sites. In drier regions, the species often grows on alkaline or somewhat brackish soils in open habitats such as pans, riverbanks, roadsides, low scrub, and bush. It is frequently encountered as a weed in cultivated areas (Achigan-Dako, 2010; Monteiro et al., 2022; Fern, 2025; Tropicos, 2025).

Invasiveness: –

Ethnobotany:
Cultural and traditional uses: The nutritional value of *Abutilon angulatum* is recognised in South Africa and Madagascar, where its leaves and flowers are eaten as a cooked vegetable (Bussmann et al., 2021). It also holds an important place in traditional medicine. In Ethiopia, the Kwego people chew its roots to relieve chest pain and symptoms of tuberculosis, such as coughing up blood (Teklehaymanot and Giday, 2010). In Mozambique and South Africa,

its roots are used to treat heart diseases and epilepsy (Sitoe, 2020; Welcome and Van Wyk, 2019). Meanwhile, in Madagascar, the fibres of the plant's bark serve the dual purpose of making textiles and acting as a remedy in the form of decoctions of the roots for coughs and labour pains (Baron, 1890; Bussmann et al., 2021). Similarly, in Tanzania, the boiled roots are consumed to relieve coughs and labour pains, while the young leaves and flowers serve as a vegetable (Quattrocchi, 2012). In South Africa, powdered roots are used for burns, while leaf-based medicines combat hiccups and respiratory diseases (Bussmann et al., 2021).

The durable fibres of the bark of *Abutilon angulatum* are used in Madagascar to make cloth and cordage. Additionally, in Zambia, the fibres are used for stitching mats (Bussmann et al., 2021). The plant's uses also include other practical applications in Madagascar and South Africa. The inner tissue of the stem is mixed with tobacco for smoking and its large leaves are used as toilet paper. The bark fibres are also processed into fishing lines, which are prized for their strength and durability (Baron, 1890; Heckel, 1908). Moreover, the flowers of this plant are used in beekeeping and its stems can act as flint (Bussmann et al., 2021).

The cultural importance of *Abutilon angulatum* extended to Rhodesia (modern-day Zimbabwe and Zambia), where it was used as a substitute for jute in the manufacture of grain sacks (Bulletin, 1927). It gained popularity as a textile especially during the First World War (Bulletin, 1919).

Scientific perspective: The chemical composition of *Abutilon angulatum* highlights its usefulness in industrial applications. With a high cellulose content of 75.2%, the plant was tested for its potential in fibre production. Other chemical properties include a moisture level of 9.6%, an ash content of 1.4%, and hydrolysis losses (α: 7.2%; β: 10.0%), indicating its moderate persistence. Acid purification losses (2.0%) and washing losses (0.7%) reflect its resilience under various processing conditions (Bulletin, 1919).

Historically, in British colonies, *Abutilon angulatum* was priced at around £9 per tonne in December 1918. However, its market performance was considered inferior to recognised jute varieties from Calcutta and China. In India, *Abutilon angulatum* was explored as a substitute for jute in grain bags and textiles, although its brittleness limited its usefulness (Bulletin, 1919; Heckel, 1908). Nevertheless, its economic potential during periods of scarcity underlines its importance as a secondary source of fibre.

Acalypha ciliata Forssk.

Family:
Euphorbiaceae Juss.

Synonyms:
Acalypha ciliata var. *genuina* Müll.Arg., *Ricinocarpus ciliatus* (Forssk.) Kuntze, *Acalypha fimbriata* Hochst. ex A.Rich.

Vernacular names:

Bangladesh (Bengali): Muktajhuri, Muka Jhuri; **Benin** (Adja): Hossudugblé; **Benin** (Dendi): Barichiri; **Benin** (Fon): Viviman téton, Axhuassamandjè; **Benin** (Gourmantché): Titayanyandi, Tekpadjeluyologa**; Benin** (Sahouè/Kotafon): Zôfiôman; **Benin** (Sampéto Village): Cacayéou; *Congo* (Mawambo): Amambalieboko; **Ghana** (Asante Twi, Ashanti): Crowera, mfofoa; **India (**Gujarati, Sabarkantha District, Gujarat): Dadari; **India** (Hindi): Kuppi; **India** (Marathi, Bhandara District, Maharashtra): Kupi Kokali; **India** (Nagaland, Dimapur District): Kuppi; **India** (Tamil, Kanyakumari, Tamil Nadu): Kuppamenichakalathi; **India** (Tamil, Palamalai Hills, Tamil Nadu): Chiruchinni; **India** (Telugu, Telangana, Sugali Tribe, Andhra Pradesh): Adavi Pippinta; **Ivory Coast** (Gouro): Sôla sônin; **Kenya** (Kamba): Uugunyali; **Nigeria** (Esan): Ifoki; **Nigeria** (Igbo): Abaleba; **Nigeria** (Yoruba): Efiri.

Conservation value: –

Distribution:

The native range of *Acalypha ciliata* extends across tropical Africa, from Mauritania and Ethiopia southwards to Namibia and Mozambique. It continues through the south-western Arabian Peninsula and reaches into the Indian Subcontinent, including Sri Lanka (POWO, 2025).

Habitat:

Acalypha ciliata occurs in a broad spectrum of habitats, including cultivated land and forest shade. It is commonly found in open and wooded grasslands, as well as in deciduous and coastal bushland. The species frequently occupies rocky or seasonally damp areas, and it is often recorded near lakes and on floodplains. It grows from sea level up to elevations of approximately 1,650 m (Schmelzer, 2007; Fern, 2025).

Invasiveness: –

Ethnobotany:

Cultural and traditional uses: *Acalypha ciliata* is used as a food source in many African and Asian countries. In the Marahoué region of Côte d'Ivoire, its leaves are cooked, crushed and mixed with palm oil to prepare traditional sauces, used primarily during periods of food shortages to improve dietary diversity. The addition of palm oil avoids a decrease in nutrient content as a result of cooking, as it preserves fat-soluble vitamins and carotenoids (Doue et al., 2021). In southern Benin, the leaves are also consumed as a leafy vegetable in various local dishes (Koukou et al., 2022). Among the Gourmantché community living in West Africa, the plant is often cooked with okra (*Abelmoschus esculentus*) or cowpea *(Vigna unguiculat*a) leaves. However, it is eaten occasionally, mainly when other vegetables are in short supply. Similarly, in Zuénoula, Côte d'Ivoire, the leaves are part of traditional meals, prepared as cooked leafy vegetables

(Germain et al., 2021).

The medicinal uses of *Acalypha ciliata* are varied and widely recognised. In Bangladesh, practitioners of folk medicine use the plant to treat diarrhoea by administering a juice extracted from the macerated leaves and roots (Das et al., 2012). The Sugali tribe of Andhra Pradesh in India uses crushed leaves to treat skin parasites and ulcers (Priya et al., 2023a). Fresh leaves are mixed with millet porridge and consumed orally as an anti-inflammatory, antibacterial and anthelmintic in Telangana, India (Priya et al., 2023a). The medicinal use of the plant also extends to regions such as Rajasthan in India, where a paste of the leaves is applied to ulcers and wounds, and the whole plant is used to treat bronchitis, asthma, pneumonia and rheumatism (Jain et al., 2009). Known for its laxative and vermifugal properties, the plant is used in the Tirunelveli hills of the Western Ghats to relieve intestinal complaints (Jothi et al., 2008). In addition, the leaves are combined with turmeric to make a paste to treat skin diseases in the Panchmarhi Biosphere Reserve, Madhya Pradesh (Kadam and Sharma, 2013). In Tamil Nadu, India, *Acalypha ciliata* leaves serve as a worm remedy and are also processed into a paste for treating scabies (Arulappan et al., 2015). The plant's therapeutic potential extends to Bangladesh and West Bengal, where the whole plant is traditionally employed to address bronchitis, pneumonia, asthma, and tuberculosis (Wiart, 2019). In Benin's Ouémé and Plateau regions, a decoction of the leaves is consumed to manage infertility (Houmenou et al., 2017). Similarly, in East Africa, the leaves and roots are utilised as remedies for schistosomiasis and ulcers, showcasing their versatility in addressing a range of conditions. Meanwhile, in Côte d'Ivoire, the leaves have a longstanding role in the traditional treatment of female infertility (Seebaluck et al., 2015).

Cultural beliefs and other uses of the plant highlight its wider social significance. People living in Ituri forests in the Democratic Republic of the Congo believe that the presence of *Acalypha ciliata* near banana trees improves fruit quality (Terashima

and Ichikawa, 2003). In Benin, the plant is central to magical practices, including rituals to attract good luck and economic prosperity. There, it is also ground and mixed with soap in bathing rituals aimed at ensuring business success (Dossou-Yovo et al., 2020). In addition, the plant serves as a key element in spiritual ceremonies in the Beninese village of Sampéto, where its roots are used in talismans to attract customers and ensure economic prosperity (Bonou, 2007). The plant is also used for ornamental purposes, decorating courtyards and building facades in south-western Nigeria (Aworinde et al., 2013).

Scientific perspective: *Acalypha ciliata* has a relatively high nutritional value, bioactive compounds, and potential medicinal uses. Its high moisture content (69.58%) and moderate levels of protein (6.34% of dry matter) and carbohydrates (12.04% d.m.) make this plant a valuable addition to the diet, especially during periods of food shortages. In addition, the plant contains antioxidants such as polyphenols, flavonoids, tannins and carotenoids, which help combat oxidative stress and contribute to overall health (Doue et al., 2021).

Although flavonoid levels are lower than in many other vegetables, they are still significant. Tannins show moderate abundance and carotenoids contribute significantly to meeting vitamin A requirements when consumed in sauces prepared with palm oil.

Studies on antioxidant retention in sauces prepared with *Acalypha ciliata* report that key compounds are present even after cooking. These are: polyphenols (20.00%), flavonoids (11.15%), tannins (17.20%) and carotenoids (27.22%) (Doue et al., 2021; Oladimeji and Akpan, 2014).

The antimicrobial properties of *Acalypha ciliata* underline its potential to combat pathogens. Ethanolic extracts show moderate inhibition against *Staphylococcus aureus* and *Bacillus subtilis*, mainly due to the presence of flavonoids and tannins (Oladimeji and Usifoh, 2015). This antimicrobial activity positions *Acalypha ciliata* as a candidate natural remedy for Gram-positive bacterial infections. Furthermore, essential oils from the plant have shown larvicidal activity against *Artemia salina* and *Anopheles gambiae* (Aboaba et al., 2012).

Acicarpha tribuloides Juss.

Family:
Calyceraceae R.Br. ex Rich.

Synonyms:
Buphthalmum bonariense Pers., *Acicarpha bonariensis* (Pers.) Herter, *Boopis tribuloides* Spreng.

Vernacular names:
Argentina (Moqoit): palor'ó lateé; **Argentina** (Spanish): Cardo torito, Rosetilla; **Argentina** (Toba): Uoué; **Argentina** (Vilela): Kis(l)í-Kis(l) í mop; **Paraguay** (Spanish): Toro rati; **Paraguay** (Toba): Uoué; **Paraguay**: Tororati; **Peru** (Quechua): Torillo-huma, Estrella-quisca, Estrella kiska.

Conservation value: –

Distribution:
Acicarpha tribuloides is native to subtropical regions of South America, including Argentina, Bolivia, southern and southeastern Brazil, Paraguay, Uruguay, and Peru (POWO, 2025). Beyond its native range, the species has been introduced into parts of the southeastern United States, where it has been occasionally observed in ruderal habitats (GBIF, 2023; POWO, 2025).

Habitat:
Within its native range, *A. tribuloides* typically inhabits disturbed and open habitats—such as roadsides, fallow or abandoned fields, pasturelands, and secondary scrub vegetation—as indicated by Tropicos specimen records. In Andean regions of Bolivia and Peru, it is collected at elevations between approximately 2,550 m and over

4,000 m, predominantly in open montane habitats such as roadside margins, mountain slopes, and dry shrublands (Tropicos, 2025) Additionally, the EPPO Global Database characterizes *Acicarpha tribuloides* as a "weed of cultivation" (EPPO, 2025a).

Invasiveness: –

Ethnobotany:

Cultural and traditional uses: Traditional uses of *Acicarpha tribuloides* are practised among South American communities, particularly in Paraguay, Argentina, Peru and Bolivia. The use of this plant is not limited to its medicinal properties only. The Guarani Indians believe that an infusion of this plant wards off curses or and protects against spiritual threats (Evert, 2008). In the Apillapampa region of Bolivia, teas made from this plant serve the dual purpose of medicinal relief and spiritual protection (Evert, 2008). In Paraguay, *A. tribuloides* is used to treat tonsillitis, pharyngitis and kidney ailments (Basualdo and Soria, 2014).

The Moqoit and Vilela peoples refer to this plant as 'palor'ó lateé' and 'Kis(l) í-Kis(l) í mop', respectively, reflecting its integration into local ethnobotanical traditions (Martínez-Crovetto, 1965; Scarpa and Rosso, 2014). Among Quechua communities in Peru, the plant is known as 'Estrella-quisca' and is used to treat gastrointestinal, respiratory and inflammatory diseases (Thomas et al., 2008; De Feo and Soria, 2012) The practical uses of the plant parts are varied. Its root is used externally to treat wounds, while an infusion of the dried aerial parts of the plant is used as an expectorant and liver aid. Furthermore, decoctions of the above-ground parts are used to treat respiratory infections, urinary tract infections, as well as kidney problems, prostatitis and toothaches (Barboza et al., 2009; De Feo and Soria, 2012).

Scientific perspective: The pharmacological properties of *Acicarpha tribuloides* have been partially studied, highlighting its potential in modern medicine. This plant contains bioactive compounds such as astragalin (flavonol) and loganin (secoiridoid) (Barboza et al., 2009). Phytochemical analyses reveal the presence of flavonoids, tannins, alkaloids, saponins and phenolic compounds, which support its antimicrobial and anti-inflammatory activity (Rivero et al., 2021).

Previous scientific studies confirm the analgesic and antispasmodic effects of the plant's chloroform and methanol extracts in animal models (Kumar and Kumari, 2021). In addition, its antibacterial properties have been confirmed - ethanolic extracts inhibit Gram-negative bacteria (*Salmonella typhimurium*, *Escherichia coli*) (Rivero et al., 2021).

In summary, the plant's traditional uses and preliminary scientific findings highlight its value in both cultural and pharmacological contexts, offering promising directions for future research.

Acmella uliginosa (Sw.) Cass.

Family:
Asteraceae Bercht. and J.Presl

Synonyms:
Ceratocephalus acmella var. *uliginosa* (Sw.) Kuntze, *Jaegeria uliginosa* (Sw.) Spreng., *Spilanthes uliginosa* Sw., *Spilanthes iabadicensis* A.H.Moore, *Spilanthes lundii* DC.

Vernacular names:
Benin (Fon/Gbe languages): Anansaara kalowao, Boubouô, Boupèbouô, Bourdierikè, Didakomfroubiali, Djidja koumalo, Gaatam migaatɛ, Kablè koulmawô, Kalwôou, Kpékpéraboubou, Kpéssèbohaa, Lôwôlôkpè, Otomkalouwè, Oulakombouonou, Sããnakpãwõgõ, Tanwouwouroussouguia, Yèyèca, Yoritampobou; **Bhutan** (Dzongkha): Heydonam; **Brazil** (Portuguese): Agrião bravo, Agrião-do-Pará, Jambu, Jambu pequeno, Oripepê; **China** (Mandarin Chinese, pinyin): Zhao sheng jin niu kou; **International (English)**: Marsh para cress; **Fiji** (Fijian): Mbotembotekoro; **Gabon** (Fang): Ndonsi; **Haiti** (French/Haitian Creole): Créosote pays, Herbe mal aux dents, Z'herbe mal aux dents; **Indonesia** (Indonesian/Sundanese): Jotang kecil, Jotang leutik, Sesemuhl; **Lesser Antilles** (French): Bouton d'or; **Malaysia** (Malay): Anting-anting, Balik Angin, Bunga Penyasyus, Daun Ludah, Galang, Kerabu, Penik, Penyasyus, Pokok Getang, Subang Nenek; **Nepal** (Nepali): Gorakba, Pirazh; **Thailand** (Thai): Hor te mi/Horte mi, Tu plei/Tuplei; **West Bengal** (Bengali): Kalijhar.

Conservation value:
Least Concern - LC (IUCN, 2025).

Distribution:
Acmella uliginosa is native to tropical America, where it occurs in Central and South America and parts of the Caribbean. Its native range includes countries such as Bolivia, Brazil, Colombia, Panama, Venezuela, and several Caribbean islands. The species has been introduced across tropical regions of Africa, South and South-East Asia, and northern Australia (Queensland) (POWO, 2025).

Habitat:

Acmella uliginosa occurs in damp ground within moist forest zones, swampy sites, grasslands along rivers, and frequently as a weed in rice fields at elevations from sea level to approximately 1,200 m (Beentje et al., 2005).

Invasiveness: –

Ethnobotany:

Cultural and traditional uses: Some of the earliest references to the traditional use of *Acmella uliginosa* come from the notes of the Swiss botanist Antoine Duss, who conducted research in Martinique in the late 19th century (Duss, 1896). According to these notes, in the event of sudden pain, the islanders crush one or two flower heads and place them under the aching tooth. The pain often disappears instantly. Interestingly, in later years the plant was found to be used for the same purpose by people in countries as far away as Brazil (Conde et al., 2014), Gabon (Betti, 2013), Indonesia (Rao et al., 2012; Ridwan et al., 2022) and Thailand (Punchay et al., 2020). It is also worth noting that in some countries, such as Haiti, the aforementioned property of this plant was so important that its local name "herbe mal aux dents" or "herb for toothache" refers to it. However, this species of weed is not only harvested for these properties. In Benin, *Acmella uliginosa* is known as a nutraceutical. It is reported to help remove blood clots after childbirth and to increase milk production in nursing mothers (Adéoti et al., 2009). The plant is also widely used in Beninese cuisine, where both young and mature leaves and young stems are used. These are usually combined with ingredients such as tomatoes and shea butter or oil to make a sauce for dishes (Vihotogbe-Sossa et al., 2012). According to local people in Benin, it can prevent intestinal worms if consumed regularly (Dansi et al., 2008). In Thailand, *Acmella uliginosa* has a variety of culinary and medicinal uses. It is eaten raw or cooked with chilli paste. In this country, however, it is not the flowers but the roots of this plant that are more commonly used to relieve toothache, a common practice in both Karen and Lawa communities. The plant is usually harvested between June and January (Punchay et al., 2020). In Gabon, the leaves of the plant are also traditionally used in medicine. They are macerated for oral administration to treat jaundice (Betti, 2013). The people of West Bengal consider its inflorescence to be an analgesic (Ghosh and Das, 2011), while in Nepal it is a popular spice (Gautam et al., 2020). In Indonesia, the plant is particularly prized around the Kedah Rainforest Lodges ecotourism area in Aceh. In this area, the inflorescence of *Acmella uliginosa* serves not only as an important analgesic, but also as a minor ingredient in local cuisine (Rao et al., 2012). In addition to ailments related to toothache, it is also said to treat scurvy and aid digestion (Leng et al., 2011).

In Brazil, the plant is particularly popular in the northern and northeastern regions, where it is used both as a spice and as a home remedy for oral ailments. Owing to its local anaesthetic properties, chewing the leaves and flowers produces a tingling, numbing sensation. As a result, the plant is used as a popular home remedy for toothache and minor wounds (Conde et al., 2014). Finally, in China, the young leaves and flower heads of *Acmella uliginosa* are considered a delicacy. They are eaten both raw and cooked (Lim, 2015).

Scientific perspective: Current scientific evidence indicates that *Acmella uliginosa* flower homogenate contains compounds with anti-inflammatory activity, suggesting a potential use in anti-inflammatory and anti-arthritic agents (Paul et al., 2016). In addition, extensive research reports pain relief, particularly reductions in pain sensitivity and management of elevated pain responses. In particular, these studies have used methanolic extracts from the plant's flowers, which indicate the presence of important bioactive compounds such as amides, α- and β- amyrin esters, myristyl alcohol glycosides, sitosterol, saponins, stigmasterol and triterpenes, many of which are associated with

diverse biological activities (Savant and Kareppa, 2022; Quattrocchi, 2012). The results also highlight the plant's analgesic, antibacterial and insecticidal properties.

Aeschynomene aspera L.

Family:
Fabaceae Lindl.

Synonyms:
Aeschynomene indica var. *aspera* (L.) Hassk. ex Miq., *Aeschynomene aquatica* Steud., *Adesmia wallichiana* Gillies ex Hook., *Hedysarum lagenarium* Roxb.

Vernacular names:
Bangladesh (Bengali): Shola; **Cambodia** (Khmer, Siem Reap): Snao, Snao 'am' bohs; **Equatorial Africa** (unspecified): M'paecee; **Ghana** (Dagbanli): Taba dugu nyurgu; **India** (Bengali): Shola, Phool shola; **India** (Hindi): Laugauni, Sola; **India** (Kannada): Tanakali; **India** (Malayalam): Ponguchedi, Neerkadasam; **India** (Odia): Sola; **India** (Tamil): Aathunetti, Attuneddi, aatru netti, alagina, alagina gida, aligina, amunkakkoti, arru netti, arrukatesam, athunetti, atru netti, attekudasa, attukatesham, ayariyam, ayiri, ayiriyam, bendu, bendu gida, catai, cataicci, cataikkoti, cayulatikam, damana, jeenangi/jinangi, jiluga, jiluga bendu, jilugu, kadessum, kare bendu, kataicci, kere bondu, kitai, kitaiccai, kitaicci, kitaiccu, kiteccai, kokkeri, kokketu, kotal, koti neti, kottirakakkoti, kottirakam, kottiram, laugauni, mamuti, narana, narukkunetti, narukkuvetti, neerunjiluga, nellitali/nellittali, nertattai, nertattaikkoti, netti, netticceti, nir jiluga, nirccunti takkai, niru-jilugu, punetti, sadai, shola, shulo, sitavirya, sola, solo, takkai, takkaipputu, tanakali, tankali gida, thige jluga, totalavakakkoti, totalavam, tuyilkana, tuyilkanacceti, venkitaicci, vintukavuli; **India** (Telugu): Neetijuluga, Nirujiluga; **International** (English): Pith plant, Shola pith, Sola pith plant, Sola plant; **International** (German): Raue Schampflanze; **International** (Mandarin Chinese): Tu niu xi, Sola cao; **International** (Portuguese): Angiquinho, pinheirinho; **Laos** (Lao, Vientiane): (Kok) sano; **Nepal** (Nepali): Dhondiya, Shakla; **Thailand** (Thai): Sano-hangkai; **Vietnam** (Vietnamese): To dia, Rut dai; **Vietnam** (Vietnamese, South): Ctien Sien tham.

Conservation value:
Least Concern - LC (IUCN, 2025).

Distribution:
Aeschynomene aspera is native to tropical Asia — spanning the Indian Subcontinent (Pakistan, India, Nepal, Bhutan, Sri Lanka) and Southeast Asia (Indochina and Malesia) — and extends naturally into northern Australia (e.g. Northern Territory). The species has also been introduced and naturalised in Queensland (Australia) (POWO, 2025).

Habitat:

Aeschynomene aspera typically inhabits the margins of freshwater wetlands, including lagoons, ponds, tanks, lakes, and jheels, as well as swampy grasslands and seasonally inundated sites. It is also commonly found in anthropogenically influenced wet environments such as ditches, flooded rice fields, and drainage canals. The species is well adapted to persist in shallow, stagnant, or slow-flowing water, and can occur from near sea level up to about 1,300 m in elevation (Assam Biodiversity Portal, 2025a; IUCN, 2025).

Invasiveness: –

Ethnobotany:

Cultural and traditional uses: The ethnobotanical significance of *Aeschynomene aspera* has a long history and varied applications across different cultures and time periods. Originating in the East Indies, Cochinchina, and Vietnam, the plant was primarily found in damp, marshy places, along riverbanks and lakes. In these regions, its dense and lightweight stem was traditionally used to make paper and intricate artificial flowers (Czerwiakowski, 1859). In Eastern Equatorial Africa, the plant had diverse applications, from being woven into corselets for fishermen to its pith being used for hats and fishing floats (Pickering, 1879). By the late 19th century in India, the plant's pith, known as "Sola" or "Shola," was used for various crafts including hats, toys, and fishing floats (Gamble, 1881; Balfour, 1885). Bengal became a major trading centre for the pith, which found multiple uses like making bottle-corks, swimming jackets, and life-belts (Manjunath, 1948).

By the 20th century, the plant's significance had spread to Australia and Sri Lanka, where its young stems were used to craft pith hats (Triman, 1894). In India, the soft stems continued to be utilised in wedding ceremonies and crafted into various adornments (Mehra et al., 1975; Francis, 1984). Into the 21st century, the plant's ethnobotanical applications expanded to include various artistic creations

and medicinal uses (Bouri and Ganguly, 2016; Das et al., 2020). Research has explored its potential hepatoprotective properties, and its extracts have been used to treat colds, coughs, and fevers (Achika and Ndukwe, 2016; Chaithra et al., 2021).

By 2022, the plant had established its multifaceted value, serving not just for crafts and medicinal purposes, but also as a fuel source (Muchjajib et al., 2014; Jena et al., 2022). The latest record from West Bengal's Purulia district in 2023 indicates that the traditional practices using the plant's root to treat arthritis continue to thrive (Mandal and Mukherjee, 2023).

Scientific perspective: Chemical analysis of the plant has revealed constituents such as glycosides, saponins, carbohydrates, alkaloids, cardiac glycosides, amino acids, ecdysterone, and hentriacontane (Imtiaz et al., 2020; Verma et al., 2021). Studies have demonstrated that *Aeschynomene aspera* leaf extract possesses bioactivities including antioxidant, analgesic, antidiarrhoeal, and anthelmintic properties. It also shows potential for antioxidant and antimicrobial actions (Barcelo, 2015). Despite these findings, the literature currently lacks comprehensive information on the chemical and medicinal properties of the plant, indicating a need for further research to fully understand its potential benefits.

Aeschynomene indica L.

Family:
Fabaceae Lindl.

Synonyms:
Hedysarum neli-tali Roxb., *Aeschynomene diffusa* J.G.Klein ex Willd., *Aeschynomene hirsuta* Vitman, *Smithia aspera* Roxb.

Vernacular names:
Brazil (Portuguese): Angiquinho, Maricazinho, Papquinha, Pinheirinho; **Cambodia** (Khmer): Snaô ach mon, Snaô ba:y; **India** (Manipuri/Meitei): Chigonglei; **India** (Tamil): Kodi thuvarai, Nettithakkai, Nelliththaali; **India** (unspecified): Kat Sola, Netti, Thakkapundu, Pilliya, Laugauni, Patagdodi; **International** (English): Budda-pea, Curly-indigo, Hard sola, Indian jointvetch, Kat Sola, Northern joint-vetch, Sensitive joint-vetch; **International** (German): Indische Schampflanze; **International** (Mandarin): Geng Tong Cao, He Meng, He Meng Gen, He Meng Ye, Lian Gen Ba, Shan Yan Huang Qi, Shui Zao Jiao, Tian Zao Jiao, Zao Jiao; **Japan** (Japanese): Kusa Goukan, Kusa Nem, Kusanemu; **Laos** (Lao): Do:k sanô:; **Micronesia** (Pohnpeian): Ikin Sihk; **Nigeria** (Hausa): Bambamko, Fidilin kanaawa; **South Korea** (Korean): Jagwipul; **Sri Lanka** (Sinhala): Diya Siyambala; **Vietnam** (Vietnamese): Âièn ctiên bu'ng, Âièn ma ân, Dâu ma; **Western Ghats** (unspecified): Tliakkapundu.

Conservation value:
Least Concern - LC (IUCN, 2025).

Distribution:
Aeschynomene indica displays a very broad global distribution, and its precise native range remains unclear (IUCN, 2025; POWO, 2025). Current evidence suggests that it is most likely native to tropical and subtropical regions of Africa, Asia (including the Indian Subcontinent and Malesia), and northern Australia, though its origin cannot be definitively determined. The species has since become widely introduced and naturalised outside its presumed native range—particularly in parts of South America, many islands of the Pacific, Indian Ocean, and Caribbean, southeastern United States, and selected regions of Europe such as Greece (POWO, 2025).

Habitat:
Aeschynomene indica thrives in wetland and semi-aquatic settings such as floodplains, pans, swamp margins, pond and river edges, and pools within wooded grasslands or bushland. It also occurs in

moist crevices on rocky outcrops and in anthropogenic wet habitats like paddy fields and roadside ditches. These occurrence patterns highlight its affinity for shallow, stagnant or slow-flowing water bodies occurring from near sea level up to approximately 1,200 m elevation (Assam Biodiversity Portal, 2025b; IUCN, 2025; JSTOR Global Plants, 2025).

Invasiveness: –

Ethnobotany:

Cultural and traditional uses: *Aeschynomene indica* leaves are traditionally consumed raw or cooked, usually in the form of soups, fritters, or potherbs. Among others, the plant is used in this way by the Kanikkaran Indian tribe living in southern Kerala and Tamil Nadu (Fern, 2025). In Burkina Faso, the leaves are used in sauces, especially during the rainy season (Belem et al., 2017). Meanwhile, in China, the young stems and leaves are prepared by boiling, steeping, frying, or mixing into dishes. Historically, in Donghai County, the seeds were ground and made into tofu and even used to make wine, although these practices have now largely fallen out of use (Hou and Qian, 1956; Chinese Academy of Sciences, 1959).

Aeschynomene indica is important in folk medicine, especially in the Chinese tradition, where it is used to treat urticaria, boils, nyctalopia, hepatitis, enteritis, and dysentery. Traditional Chinese medicine considers *Aeschynomene indica* a detoxifier, useful for liver ailments and for improving eyesight, further emphasising its antipyretic, diuretic, and haemostatic effects (Hou and Qian, 1956; Chinese Academy of Sciences, 1959). Among the Kanikkaran tribe, a decoction of the leaves combined with *Andrographis panniculata*, *Andrographis lineata*, the roots of *Thespesia populnea*, and the stem bark of *Strychnos nux-vomica* is administered internally for a period of 40 days to counteract snakebite (Ayyanar and Ignacimuthu, 2005; Fern, 2025).

In India, the plant is used as a remedy for kidney stones and urinary disorders and is also recognised for its spermicidal properties (Ayyanar and Ignacimuthu, 2005; Fern, 2025). In Manipur, for example, the young leaves are eaten fresh in salads to deal with urinary problems. In addition, extracts combined with black pepper help relieve painful urination (Lokendrajit et al., 2011). Remaining in India, the Oraon tribe uses the root as a magical cure for jaundice. Moreover, the Kani tribe uses it as an antidote for snakebites; the Chenchu tribe uses it for kidney and urinary ailments, and the Piliyar tribe values it for treating bovine skin eczema. Ayurvedic texts note its efficacy against gallstones. However, in the Siddha medical system, it is prescribed for leprosy (Aruna et al., 2012; Bharathi and Rao, 2015).

In addition to its dietary and medicinal value, *Aeschynomene indica* has many utilitarian functions. For example, the charcoal derived from it was historically used to make gunpowder (Bharathi and Rao, 2015). Its leaves are not only edible, but also used as compost to improve soil fertility (Aruna et al., 2012). Culturally, 'Sola' items made from the plant are used in Bengal to decorate figurines of deities such as Goddess Durga and Kali (Aruna et al., 2012). In India, *Aeschynomene indica* is sometimes cultivated for ornamental purposes, and its buds are added to vegetable dishes (Presl and Presl, 1846). As a material, the plant, similar to *A. aspera*, has been used to make helmets, artificial flowers, models, and toys (Fern, 2025). On Guam, the stem was traditionally used to carve small figurines of saints (Safford and Safford and Safford, 1905). In China, the same pith is used to make sun hats, floats, swimming belts, and bottle stoppers (Hou and Qian, 1956; Chinese Academy of Sciences, 1959).

Scientific perspective: Available research indicates significant antibacterial potential of *Aeschynomene indica*. Alcoholic leaf extracts have shown efficacy against both Gram-positive (*Staphylococcus aureus*, *Bacillus subtilis*) and Gram-negative (*Escherichia coli*, *Pseudomonas aeruginosa*) bacteria (Aruna et al., 2012). Studies on the essential oils of the plant, in turn, reported strong activity against *S. aureus* and *B. subtilis.* When combined with commonly used antibiotics, such as streptomycin and chloramphenicol, the essential oils have shown synergistic properties, highlighting their promising potential as treatment enhancers (Feng et al., 2024).

Phytochemical studies of *A. indica* highlight its rich flavonoid and phenolic content, especially in ethyl acetate and ethanol extracts, which confer significant antioxidant properties (Bharathi and Rao, 2015). In addition to its antioxidant potential, *A. indica* has shown noteworthy cytotoxicity against breast cancer cell lines (Feng et al., 2024). Furthermore, the key active constituents — (E)-caryophyllene, linalool,

viridiflorol and phytol — exhibit antimicrobial, antioxidant and anticancer properties. This makes *A. indica* a promising candidate for further research into its potential applications in oncology (Feng et al., 2024).

The plant also demonstrates promising therapeutic properties in wound treatment. Extracts from *A. indica* appear to enhance wound healing by accelerating macrophage phenotype change and alleviating scar formation (Lei et al., 2019). Thanks to their strong antioxidant profile, the flavonoids in the plant may also offer preventive benefits for oxidative stress-related diseases, including cardiovascular ailments and diabetes (Bharathi and Rao, 2015).

Aeschynomene sensitiva Sw.

Family:
Fabaceae Lindl.

Synonyms:
Aeschynomene fistulosa Bello, *Aeschynomene honesta* Nees and Mart., *Aeschynomene sulcata* Kunth, *Cassia paramariboensis* Miq.

Vernacular names:
Brazil (Portuguese/Amazonas): Angiquinho, Tintarana; **India** (Malayalam/Malabar): Todda-Vaddi; **Madagascar** (Antankarana): Velonarivotaona, Fangnivan; **Madagascar** (Betsileo): Anjananjana, Tsitakombohitra; **Madagascar** (Betsimisaraka): Fanombo Tintina; **Madagascar** (Malagasy): Hiamotra, Anjanaiana, Ramianoka; **Madagascar** (Sakalava): Hamatra, Hamotra, Hazonantambo; **Nigeria** (Hausa): Bambamko.

Conservation value: –

Distribution:
Aeschynomene sensitiva has a broad native range across tropical and subtropical America, from Mexico and the Caribbean through Central and South America, including Brazil, Bolivia, Argentina, and Peru. It is also native across sub-Saharan Africa, with confirmed native presence in countries ranging from Senegal and Ghana to Uganda, Tanzania, Mozambique, and Madagascar. The species is also reported as introduced in several western Indian Ocean islands: Comoros, Mauritius, and Réunion (POWO, 2025)

Habitat:
Aeschynomene sensitiva typically inhabits wet, seasonally or permanently waterlogged environments, such as marshes, swampy meadows, riverbanks, irrigation ditches, and rice paddies. It is commonly found in disturbed lowland areas, particularly in tropical and subtropical climates, where periodic flooding creates ideal conditions for growth. The species shows a preference for hydromorphic soils, often clay-rich and moderately to highly fertile, and occurs at elevations ranging from sea level up to approximately 1,500 metres (Polhill, 1993; WIKTROP, 2023a; WFO, 2025).

Invasiveness: –

Ethnobotany:

Cultural and traditional uses: In Madagascar, *Aeschynomene sensitiva* has an important place in the traditional medicine of various ethnic groups. Among the Sakalava people, the plant, known as Hamatra or Hamotra, is valued for its laxative properties, and its flower tops are often used to prepare infusions applied externally to desquamate the skin (Boiteau et al., 1999). The Sakalava people also call this plant by another name, Hazonantambo, from hazo (tree) and antambo (misfortune). This is related to the fact that, according to local beliefs, the plant is associated with misfortune and has historically found use among local sorcerers (Boiteau et al., 1999).

The Antankarana community uses the leaves of the plant in decoctions to alleviate labour discomforts. Preparations are sometimes combined with other medicinal plants such as *Ocimum gratissimum* (rhomba) and *Ageratum conyzoides* (bemaimbo). This plant is also used in steam baths to relieve fever and flu symptoms (Nicolas, 2012). Meanwhile, among the Betsimisaraka in Ambalabe, the plant is traditionally used to treat malaria. For this purpose the leaves are usually decocted and administered orally (Rakotoarivelo et al., 2015).

Besides Madagascar, the plant is also used in South America. In Suriname, the above-ground parts are used by the Aucan tribal people to treat hypertension (Mans et al., 2022). In the Colombian Caribbean region, the genus *Aeschynomene* is traditionally used to treat pain and swelling (Rangel et al., 2024). In Brazil, the leaves of the plant are traditionally considered aphrodisiacs, further emphasising its cultural significance (Peckolt, 1898).

Scientific perspective: *Aeschynomene sensitiva* exhibits significant bioactive properties, contributing to its therapeutic and pharmacological potential (Arruda et al., 2018; Mans et al., 2022). Key compounds include rotenoids (glycosylated 6′-hydroxy-6a,12a-dehydrorotenone); isoflavonoids (glycosylated 2′,7-dihydroxy-4′,5′-dimethoxyisoflavone); flavonoids (quercetin-3-O-β-D-glycoside); phenolic compounds (gallic acid and methyl gallate); and saponins (soyasaponin I).

Studies highlight the plant's significant antioxidant, anticancer, and anti-inflammatory activities (Mans et al., 2022). For example, the ethyl acetate fraction of the seeds inhibited croton oil-induced ear swelling in mice in 57.2% of cases (Arruda et al., 2018).

In addition to its medicinal uses, the plant exhibits its selective insecticidal activity. Its seeds and pods are toxic to the larvae of the melon borer *(Diaphania hyalinat*a) (Jacobson, 1953). Plant parts, both in powdered form and as extracts, have shown toxicity to house flies, mosquito larvae, and various leaf-eating insects (Puerto Rico Experiment Station, 1937; Plank, 1950).

Agalinis communis (Cham. and Schltdl.)

Family:
Orobanchaceae Vent.

Synonyms:
Gerardia communis Cham. and Schltdl., *Gerardia communis* f. *minor* Chodat and Hassl.

Vernacular names:
Argentina (Spanish): Conejito de campo, Salvia de la hora, Salviflora, Salvilora; **Argentina** (Vilela): piis(ļ)í maiepguép umpatpalít; **Argentina** (Qom): epák lauoní; **Uruguay** (Spanish): Moralito.

Conservation value: –

Distribution:
The native range of this species extends from south-eastern and southern Brazil to Paraguay, Uruguay, and northern and central Argentina (POWO, 2025)

Habitat:
Agalinis communis occurs primarily in open herbaceous ecosystems, including natural and montane grasslands, and wet meadows (Flora do Brasil, 2020, 2023; EOL, 2025). The species also inhabits hydric habitats, particularly along the margins of wetlands, such as marshes, swamps, and bogs, where soils are seasonally or permanently saturated (Patagonia Wildflowers, 2011). These observations, based on collector records and ecological data, suggest that *A. communis* is adapted to fluctuating moisture conditions, from well-drained to intermittently inundated environments.

Invasiveness: –

Ethnobotany:

Cultural and traditional uses: *Agalinis communis* is of significant importance in the traditional medicine and cultural practices of southern America. The herb of this plant, sold in local stores, is used in traditional medicine as a diuretic, laxative, emmenagogue, and analgesic (Priore et al., 1989; Del Vitto et al., 1997; Barboza et al., 2009; Vercelli et al., 2013). This species is considered an integral part of the medicinal flora of alkaline wetlands in the Azul Creek basin in Argentina (Vercelli et al., 2013).

Scientific perspective: Scientific studies have shown that *Agalinis communis* exhibits antifungal activity, demonstrating efficacy against fungal pathogens such as *Candida albicans* and *Trichophyton mentagrophytes*, which are responsible for common infections in humans (Martino et al., 2008). The above-ground parts of the plant contain a diversity of bioactive compounds, including aucubin, shanzhiside methyl ester, 5-deoxypulchellozide I, bartsioside, gardoside methyl ester, 8-epi-loganine, and verbascoside (Von Poser et al., 1996; Barboza et al., 2009). The iridoid compounds found in *Agalinis communis* are considered valuable chemotaxonomic markers (Von Poser et al., 1996).

Ageratum conyzoides L.

Family:

Asteraceae Bercht. and J.Presl

Synonym:

Carelia conyzoides (L.) Kuntze, *Eupatorium conyzoides* (L.) E.H.L.Krause, *Ageratum latifolium* Cav., *Sparganophorus obtusifolius* Lag.

Vernacular names:

Bangladesh (Bengali): Motmoti; **Brazil** (Portuguese): Cacália-mentrasto, Camará-opela, Catinga-de-barão, Catinga-de-bode, Cúria, Erva-de-são-joão, Erva-de-são-josé, Maria-preta, Mentrasto, Picão-branco, Picão-roxo, Erva-de-santa-lúcia; **Cameroon** (Ewondo): Nyada elog ; **India** (Hindi): Jungli Pudina, Pama; **India** (Karnataka): Oorala gida; **India** (Kerala): Appa; **India** (Meghalaya): Bat nongrim, Kynbatblu myngai; **India** (Tamil): Pumpullu; **India** (West Bengal): Uchanti; **Indonesia** (Indonesian): Babadotan/Babodotan/Babandotan, Siamih; **Indonesia** (Dayak Banyadu, Teriak Village): Ampis Kambing; **Indonesia** (Harau, Lima Puluh Kota Regency): Babadotan/Babodotan/Babandotan; **International** (Portuguese): Mentrasto, Catinga-de-bode; **Nepal** (Nepali): Gande Jhar; **Nepal** (Ilam Tea Estate): Seto Gandhe; **Nigeria** (English): White Weed; **Nigeria** (Yoruba): Imi-Esu; **Philippines** (Agusan Manobo): Albahaca; **Philippines** (Tagalog): Bulak-manok; **Sri Lanka** (Sinhalese): Hulan-tala.

Conservation value:

Least Concern - LC (IUCN, 2025)

Distribution:

Ageratum conyzoides is native to Mexico, the Central, Gulf, North-East, North-West, and South-West regions. It has been widely introduced and naturalised across tropical and subtropical regions worldwide. The species now occurs throughout much of Central and South America, sub-Saharan Africa, South and Southeast Asia (including India, Pakistan, and Indonesia), as well as parts of Oceania (e.g., Fiji, Samoa, New Caledonia), the Caribbean, and the southern United States (e.g., Florida, Alabama, California) (POWO, 2025).

Habitat:

Ageratum conyzoides occurs in a wide variety of disturbed and semi-natural habitats throughout tropical and subtropical regions. It is commonly found in agricultural landscapes, including rice fields, pastures, and plantations, particularly in humid environments. The species is also widespread in ruderal habitats such as roadsides, vacant lots, abandoned cropland, and railway margins. Furthermore, it is frequently recorded in riparian zones, open woodlands, scrublands, and wetlands,

especially along streambanks and seepage areas (Lucid Central, 2014a; WIKTROP, 2023b; GISD, 2025a). It tolerates a broad range of soil types and is typically associated with moist, disturbed soils, from lowland areas up to elevations exceeding 2,000 m. Its ecological adaptability enables it to establish in both natural ecosystems (e.g., forest margins, riparian corridors) and heavily modified landscapes, making it a resilient and invasive weed in tropical agroecosystems (WIKTROP, 2023b; GISD, 2025a).

Invasiveness:

Ageratum conyzoides is widely recognised as an invasive species in tropical and subtropical regions worldwide. It is listed in the Global Invasive Species Database (GISD) due to its aggressive spread, ecological impact, and interference with agriculture (GISD, 2025a). Originating from tropical America, the species has naturalised extensively in Africa, Asia, Oceania, and parts of North America and Australia. Regionally, *A. conyzoides* is considered invasive in East and Southern Africa (including Kenya, Tanzania, South Africa, and Malawi), where it colonises disturbed grasslands, croplands, and forest margins, often replacing native herbaceous flora (Vélez-Gavilán, 2016; Invasive Species South Africa, 2023). In South and Southeast Asia, including India, Indonesia, the Philippines, and Vietnam, it is a common and difficult-to-control weed of rice paddies, fallow land, and roadside habitats (CABI, 2016; Kaur et al., 2023). In Australia, the species is classified as an environmental weed in Queensland and parts of New South Wales, spreading rapidly along riverbanks, roadsides, and degraded habitats (Lucid Central, 2025a). In Pacific Islands such as Fiji and Papua New Guinea, *A. conyzoides* is one of the most persistent invasive plants, frequently forming dense monospecific stands and altering successional dynamics in forest edges (PIER, 2025). The plant reproduces prolifically, with a single individual capable of producing tens of thousands of wind-dispersed seeds. Its allelopathic properties and fast growth allow it to suppress native species, reduce pasture productivity, and compete with crops such

as maize, rice, and groundnuts, causing yield losses of up to 70% in some cases (Kaur et al., 2023).

Ethnobotany:

Cultural and traditional uses: In Indonesia, *Ageratum conyzoides* is widely distributed and known for its wound-healing properties (Harahap et al., 2022). The Dayak Banyadu community uses the plant to treat fever, abdominal pain, and bloody diarrhoea, administering a leaf-based infusion two or three times a day (Elisetana et al., 2023). Among West Papuan tribal communities, including the Sough, Hatam, Meyah, and Moile tribes, extracts of the leaves are used externally to treat wounds, as well as to soothe irritated eyes. In addition, juice squeezed from the leaves of this plant is consumed to relieve post-partum discomfort (Lense, 2012). In Lubuk Alung, Padang Pariaman Regency in West Sumatra, the leaves are mashed and applied to wounds to speed healing (Sari, 2019). Similarly, in Harau, Lima Puluh Kota Regency, the leaves are ground into a paste and used to treat wounds, fever, cough, infertility, jaundice, hair loss, conjunctivitis, and abdominal pain (Rizki et al., 2021).

In India, *Ageratum conyzoides* is also widely used in traditional medicine. In Kerala, tribal communities such as Kurichia, Kuruma, Kattunaika, and Paniya use a paste of the leaves externally to treat wounds (Prasad and Shyma, 2013). The juice of the leaves is applied to the forehead to relieve headaches (Arun et al., 2013). In Meghalaya, the plant is used to treat typhoid fever, and the whole plant, combined with the fruit of *Piper peepuloides* and the rhizome of Acorus calamus, is crushed and consumed orally to treat ulcers (Sen et al., 2016). In Karnataka, the plant serves as a nerve tonic and is valued for treating gastrointestinal ailments. The leaves are particularly known for their astringent properties (Kumar and Shiddamallayya, 2016). In Nepal's Khimti region, the whole plant is traditionally used as a diuretic (Sigdel et al., 2013). In Bangladesh, the leaves are macerated into juice by Kavirajes (traditional herbal practitioners), which is then administered orally until diarrhoea symptoms subside (Das et al., 2012). In the Philippines, the Agusan Manobo community collects the leaves and applies them to cuts and wounds as medicine (Dapar et al., 2020).

In African countries, such as Nigeria, decoctions of the leaves are consumed to treat malaria and febrile conditions (Sodaeizadeh et al., 2009), while the squeezed leaves are applied to the skin or consumed orally to relieve cramps, wounds, and skin rashes (Olanipekun, 2023). In Cameroon, *Ageratum conyzoides* is known as the 'royal plant' and is used to treat wounds, gastritis, migraines, and to stop bleeding. The crushed leaves and stems are applied externally or consumed orally. The plant is also mixed with *Angylocalyx oligophyllus* to treat skin diseases in children, such as redness or thrush (Fongod et al., 2014).

In South America, *Ageratum conyzoides* is similarly valued for its haemostatic and wound-healing properties. In Brazil, decoctions are used as analgesics, anti-inflammatories, and to treat arthritis, rheumatism and menstrual cramps. External applications of ointments made from the plant are used to relieve joint pain and injuries (Lorenzi and Matos, 2021).

Scientific perspective: *Ageratum conyzoides* is a species rich in bioactive compounds. The plant contains alkaloids known for their effects on the nervous, renal (diuretic), respiratory, and gastrointestinal systems. It also exhibits anti-malarial properties (Oladimeji and Usifoh, 2015). Flavonoids, including quercetin and kaempferol glycosides, provide antimicrobial, antioxidant, and anti-cancer effects, while terpenes exhibit antimicrobial and antiseptic effects (Oladimeji and Usifoh, 2015; Lorenzi and Matos, 2021). Tannins have astringent, anti-inflammatory, and wound-healing properties, in addition to saponins showing anti-fungal properties and lowering cholesterol (Oladimeji and Usifoh, 2015). Essential oils extracted from *Ageratum conyzoides* are rich in β-caryophyllene and precocene I and II. Fixed oils in the plant contain fatty

acids, triglycerides, and hydrocarbons, enhancing its therapeutic profile (Lorenzi and Matos, 2021). Pyrrolizidine alkaloids, such as lycopsamine and echinatine, found in the flowers, serve as pollinator attractants, but can be hepatotoxic, indicating that only the vegetative parts can be used for medicinal purposes (Lorenzi and Matos, 2021).

Experimental studies have demonstrated hypoglycaemic and anti-hyperglycemic effects of aqueous extracts of *A. conyzoides* leaves in rats with diabetes. A significant reduction in blood glucose levels was observed, with a maximum reduction of 27.15% at a dose of 300 mg/kg over eight hours. The plant's bioactive compounds, including mono- and sesquiterpenes, triterpenoids, sterols, alkaloids, coumarins, and essential oils, form the basis of its pharmacological properties (Ndip et al., 2013).

The plant exhibits antimicrobial properties, although its activity against pathogens varies. It shows weak antibacterial activity against *Escherichia coli* (Oladimeji and Usifoh, 2015). However, the demonstrated antibacterial activity against *Salmonella enteritidis* is consistent with its traditional use in the treatment of diarrhoea (Das et al., 2012).

Ageratum conyzoides is a medicinal plant of high commercial value, especially in Karnataka, India, where it is an integral part of Ayurvedic and herbal medicine systems (Kumar and Shiddamallayya, 2016).

Ajuga integrifolia Buch.-Ham. ex D.Don

Family:
Lamiaceae Martinov

Synonyms:
Ajuga bracteosa Wall. ex Benth., *Ajuga alba* (Gürke) Robyns, *Ajuga remota* Benth.

Vernacular names:
Ethiopia (Amharic): Armagussa, Etse Libawit, Medhanit; **Ethiopia** (Kembatta): Anamura; **Ethiopia** (Oromo/Amharic): Harmmaguusa, Aqorarache; **Ethiopia** (Sheko): Kursi-Charo; **Ethiopia** (Sidama): Anamuro; **Ethiopia** (Tigrigna): Endifdif; **India** (Bihar): Ratpatiya; **India** (Hindi): Neelkanthi/Neelkant/Nilkanthi, Kadwipatti, Neelbadi, Rat Patya/Ratpatia; **India** (Hindi, Himalayan regions): Kori-Butti; **India** (Kashmiri): Janiadam; **India** (Mishing): Nilakantha; **India** (Punjabi): Bungle; **India** (unspecified): Faniadaur; **International** (English): Many-Bracteole Bugle; **International** (Mardarin): Jiu Wei Yi Zhi Hao; **Kenya** (Luhya): Imbuli Yomtakha; **Pakistan** (Pashto): Booti/Botee, Gooti; **Pakistan** (Punjabi): Kauri Booti.

Conservation value: –

Distribution:

The native range of this species includes north-eastern, east-central, and eastern tropical Africa, the Arabian Peninsula, and it extends from Afghanistan to western New Guinea (POWO, 2025).

Habitat:

Ajuga integrifolia occurs predominantly in montane and submontane ecosystems. It grows in wooded grasslands, forest openings, and wet open grasslands that are often subject to seasonal burning, typically at elevations between 1,100 and 3,400 m above sea level. Under its synonym *Ajuga bracteosa*, the species has also been recorded on grassy hillsides, roadsides, and as a facultative weed in upland and terraced rice fields, where intermittent disturbance and adequate drainage promote its establishment in agricultural settings (POWO, 2025; India Flora Online, 2025).

Invasiveness: –

Ethnobotany:

Cultural and traditional uses: The leaves of *Ajuga integrifolia* are used in many countries as a source of traditional medicine. In the Kilte Awulaelo district of Ethiopia, they are crushed and applied topically to treat *tinea capitis* (scalp ringworm). To treat parasitic ailments such as human roundworm and tapeworms, the leaves are crushed, filtered, and the juice is consumed (Teklay et al., 2013). Among Ethiopian Aleta-Chuko communities, the juice extracted from the leaves is often mixed with water or milk for the general relief of abdominal pain in both humans and livestock (Gebre and Chinthapalli, 2021). In Ada'a district, the powdered root and leaf mixed with the powdered root of *Allium sativum* are consumed for this purpose. In addition, concoctions from this plant that also contain the roots of *Solanecio gigas, Leonotis raineriana, Olea europaea* subsp. *cuspidata* and *Datura stramonium* are used to treat gout. Furthermore, decoctions of the root and leaves are used to treat hypertension (Kefalew et al., 2015).

In Pakistan, a decoction of *Ajuga integrifolia* leaves is given to women to facilitate childbirth. In addition, the plant is used to treat diabetes (Kunwar et al., 2021). The leaves are also chewed to relieve sore throats. A decoction of the leaves is used to treat jaundice, hypertension, kidney pain, and fever (Cocquyt et al., 2011). In Tarnawai, Pakistan, crushed leaves mixed with water are eaten before breakfast for gastric hyperacidity. Crushed leaves are also applied to the ears to relieve ear pain (Taj et al., 2018).

In India, Nepal and China, the plant is used as a blood purifier and a remedy for burns, cuts, and boils. Infusions of the leaves are given for pneumonia, bronchitis, stomach pain, and typhoid fever, while mixtures with black pepper are used to treat diabetes and oedema (Quattrocchi, 2012). In Ayurvedic practices, the plant is used to detoxify the blood and treat malaria, jaundice, and digestive problems (Gebre and Chinthapalli, 2021).

The Sidama people of Boricha district in Ethiopia also prepare decoctions of its above-ground parts to treat malaria (Asnake et al., 2016). Similarly, the Mishing community of Jonai in Assam prepares a decoction of the root with honey for this purpose (Wangpan et al., 2016). In turn, the Luhya people of Kenya treat malaria by orally administering the plant's ground leaves (Sikuku et al., 2023).

Scientific perspective: The anti-inflammatory activity of *Ajuga integrifolia* has been established in TPA (12-O-tetradecanoylphorbol-13-acetate)-induced oedema and other inflammatory conditions, with a significant reduction in inflammation attributed to its bioactive compounds. Additionally, chloroform and aqueous extracts of the plant have shown analgesic effects mediated by opioid receptors, making the plant a promising candidate for the treatment of pain (Guglani et al., 2023).

Ethanolic extracts of *Ajuga integrifolia* have also shown efficacy in relieving symptoms of arthritis

and rheumatism, supporting the plant's traditional use in treating these conditions. Moreover, the aqueous-alcoholic extracts revealed significant hypoglycaemic activity in diabetic rats, indicating their potential as a natural antidiabetic agents. It has also been shown that *Ajuga integrifolia* exhibits potent antimicrobial and chemosuppressive activities (Guglani et al., 2023). The aerial parts have also demonstrated significant antioxidant properties. This activity is attributed to phenolic and flavonoid compounds, such as chlorogenic acid, rutin, taxifolin, dihydromyricetin, and kaempferol, which also contribute to the plant's antimicrobial efficacy against *Shigella* spp. (Tessema et al., 2023).

Ethyl acetate extract from the leaves of *Ajuga integrifolia* has shown significant anticonvulsant effects in acute and chronic seizure models, including artificially induced seizures in mice. These effects are attributed to modulation of GABA (γ-aminobutyric acid) receptors and blockade of sodium channels (Desalegn and Engidawork, 2023).

Alternanthera philoxeroides (Mart.) Griseb.

Family:
Amaranthaceae Juss.

Synonyms:
Achyranthes philoxeroides (Mart.) Standl., *Bucholzia philoxeroides* Mart., *Telanthera philoxeroides* Moq.

Vernacular names:
Argentina (Spanish): Camalote, Camalotillo, Gamba Rusa, Guambarusa, Lagunilla, Raíz Colorada; **Bangladesh** (Bangla): Malancha; **Bolivia**: Yerba de Pollo; **Brazil** (Portuguese): Bredo-d'Água, Erva-de-Jacaré, Mata-bicho, Perna-de-saracura, Pé-de-Pomba, Perpétua, Tripa-de-Sapo; **Burma** (Myanmar): Kanabaw, She-ka-na-phot; **China** (Lahu): A-hpe, G a'vw; **China** (Wu): Xi han lian zi cao; **China** (Yue): Pang qi ju, Kong xin xian; **India** (Hindi): Danta, Malancha; **India** (Kannada): Dodda honagonne, Mosale honagonne; **India** (Kerala): Kozhuppa; **India** (Manipur/Meitei): Komprek; **India** (North Andaman): Ponne; **India** (West Bengal): Sanchi, Salincha, Saja; **Indonesia** (Indonesian): Jukut krumini, Krokot, Tolod; **International** (Danish): Papegøjeblad; **International** (English): Alligatorweed, Khaki weed, Pigweed; **International** (French): Alternanthère; **International** (German): Papageienblatt; **International** (Mandarin): Xǐhàn liánzǐcǎo, Shuǐhuāshēng, Kong xin cai; **International** (Portuguese): Alternanthera; **International** (Russian): Ocherednopil'nik filokserovidnyy; **International** (Spanish): Alternantera, Lagumilla; International (**Swahili**): Mchicha; **Israel** (Hebrew): Beetzan; **Java** (Javanese): Krokot; **Nepal** (Nepali): Jala Jambu; **Paraguay**: Hierba Alligator; **Senegal** (Wolof): Mbum bu gór; **Sri Lanka** (Sinhala):

Kimbulwenna; **Thailand** (Thai): Phakpet, Phakpet-nam; **Uruguay** (Spanish): Carrapicho do brejo, Gamba rusa, Lagunilla, Periquito, Raíz Colorada.

Conservation value: –

Distribution:

The native range of this species extends from Trinidad to northern Argentina. It has been introduced to the south-eastern United States, parts of Central America, the Caribbean, South and South-East Asia, East Asia, Australasia, and southern Europe (POWO, 2025).

Habitat:

Alternanthera philoxeroides is an amphibious perennial plant that thrives in a broad range of aquatic and semi-aquatic habitats. It commonly forms dense mats in freshwater environments such as rivers, canals, ponds, ditches, and wetlands. Additionally, it can establish in moist, disturbed terrestrial habitats, including irrigated agricultural lands like rice paddies and wet pastures. The species is highly adaptable, tolerating periodic flooding and drought by surviving through robust rhizomes and stolons, which facilitate its persistence in both aquatic and terrestrial ecosystems (EPPO, 2025; North Carolina State University Extension, 2025).

Invasiveness:

Alternanthera philoxeroides is listed in the Global Invasive Species Database (GISD) as one of the world's most damaging invasive plants due to its broad ecological amplitude and substantial economic impacts (GISD, 2025). Native to South America, it has spread to over 30 countries across four continents - Asia, North America, Oceania, and parts of Europe (Pan et al., 2007). It reproduces vegetatively via stem fragments, forming dense mats that outcompete native flora, obstruct waterways, and disrupt agriculture and infrastructure (U.S. Fish and Wildlife Service, 2023/2024). In China, *A. philoxeroides* is widespread in 28 provinces, with ecological modelling predicting further expansion due to its environmental tolerance and competitive traits (Chen et al., 2008). In the United States, it is well-established in south-eastern states (e.g., the Carolinas, Georgia, and Florida) and is managed through active biological control programmes. Australia and New Zealand classify it as a regulated noxious weed under national biosecurity legislation (Business Queensland, 2024). In Europe, its distribution remains limited (e.g., France, Italy), but it has been placed on the EPPO Alert List and is regulated under the EU Invasive Alien Species Regulation (EASIN/JRC, 2024). The species' invasiveness is primarily driven by rapid vegetative propagation, tolerance to environmental stress (e.g., flooding), and the absence of natural enemies in introduced habitats, allowing it to dominate disturbed ecosystems (Pan et al., 2007).

Ethnobotany:

Cultural and traditional uses: *Alternanthera philoxeroides* holds an important place in the traditional diet of peoples living in southern and south-eastern Asia. In China, its leaves are eaten cooked or raw and are a common ingredient in sauces (Yeh et al., 2017). Similarly, in Myanmar,

specifically in southern Shan State, wild shoots are often added to salads (Thant, 2017). Among Khasi communities in India, the plant is eaten fresh, mixed with other vegetables, or fermented to make chutney (Agrahar-Murugkar and Pal, 2004). In Kerala, the plant is considered a delicacy and is sold in local markets as a leafy vegetable (Wagh et al., 1995). Similarly, in Jalpaiguri, West Bengal, local communities cook and eat it as a vegetable (Kumar et al., 2018). In Chhattisgarh, the plant is grown and stored for further consumption during lean periods (Samant et al., 2007). In Bangladesh, the plant is also considered a staple leafy vegetable in Chapai Nawabganj District (Rahman and Khatun, 2020). Traditional culinary practices in Thailand include combining *Alternanthera philoxeroides* with tomatoes and shea butter to make a sauce or eating it with chilli paste (Yeh et al., 2017).

In South America, people in Argentina and Paraguay prefer the tender leaves and stems, steaming them or eating them raw as vegetables (Rapoport et al., 2009). In Brazil, the leaves and young tops are used in numerous recipes, including cakes. This is especially true in the Porto Alegre region (Kinupp, 2007).

In the context of traditional medicine, *Alternanthera philoxeroides* is used extensively, particularly in Chinese medicine. Traditionally, it has been used as a heat-removal, diuretic, blood-cooling and detoxifying agent. The plant is also used to treat conditions such as B encephalitis, early-stage influenza, tuberculosis, eczema, hemiplegia, vitiligo, viper bites and haemorrhagic conjunctivitis. Fresh leaves (30-60 g) are decocted in water to treat flu and fever, while larger amounts (60-120 g) are used similarly, with added sugar, to treat haemoptysis of pulmonary tuberculosis. In the case of venomous snakebites, a significant amount (120-240 g) is crushed to make juice for oral consumption, and the residue is applied to wounds. It is believed, moreover, that regular consumption of the plant prevents intestinal worms and aids recovery from childbirth, while increasing milk production (Yeh et al., 2017).

In India, the plant is traditionally used to treat dysentery, and the shoots and leaves are also consumed as an anthelmintics (Quattrocchi, 2012). It is also valued for its effectiveness in treating intestinal ailments (Arya et al., 2022). In Argentina, its roots and leaves are used for diuretic, purgative, digestive and hepatic treatments. In addition, infusions of dried leaves and stems are prepared to treat viral diseases such as hepatitis, epidemic parotitis, haemorrhagic fever and influenza (Barboza et al., 2009).

Scientific perspective: *Alternanthera philoxeroides* shows significant culinary and pharmacological potential, supported by its diverse nutritional composition and bioactive properties. A detailed analysis of dry matter reveals 19.6% protein, along with essential minerals such as calcium (1.3%), magnesium (0.72%), phosphorus (0.33%), iron (0.014%), potassium (4.4%), copper (0.0008%), manganese (0.0115%) and zinc (0.011%) (Rapoport et al., 2009). In addition, mineral concentrations include magnesium (720 mg/100 g), manganese (11.5 mg/100 g), zinc (11.4 mg/100 g), sulphur (480 mg/100 g) and boron (2.4 mg/100 g) (Kinupp,

2007). These values underscore its potential as a nutritious food source.

Chemical analysis of *Alternanthera philoxeroides* further reveals a high diversity of bioactive compounds, which confirms its wide use in folk medicine. Dried leaves and stems contain alternanthera, alternanthera B, N-trans-feruloyl-3,5-dimethoxytyramine, glutamic acid, aspartic acid, pheophytin a, pheophytin a', oleanolic acid, β-sitosterol, 3β-hydroxystigmast-5-en-7-one, α-spinasterol, 24-methylenocycloartenol, cycloeucalenol, phytol, α-ionone and triglycerides (Barboza et al., 2009, Arya et al., 2022).

Alternanthera sessilis (L.) DC.

Family:
Amaranthaceae Juss.

Synonyms:
Achyranthes sessilis (L.) Besser, *Gomphrena sessilis* L., *Illecebrum sessile* (L.) L., *Paronychia sessilis* (L.) Desf.

Vernacular names:
Bangladesh (Bengali): Chanchi, Haicha, Sachishak; **Benin** (Adja): Gomi; **Benin** (Anii): Atakuluesuan, Guinédéné, Guinnindanou; **Benin** (Cotafon, Sahouè): Agouègbé, Agouèman; **Benin** (Fon): Houngbé; **Benin** (Goun): Agwè-houngbè; **Benin** (Holly): Idé; **Benin** (Mahi): Gwè; **Benin** (Wémè): Agoué; **Benin** (Yoruba): Ossoun odô., Agômayan Goudé; **Brazil** (Portuguese): Rubra, Violácea, Apaga-Fogo, Carrapichinho, Espinafre-Amazonico, Orelha-de-Macaco; **Cambodia** (Khmer): Cheng bângkong, Phak phew; **China** (Chaoshan): 节节花 (Jié jié huā); **Cook Islands** (Maori): Mata Kura; **Fiji** (Fijian): Geul, Galuti; **Ghana** (Gbe-Vhe): Tosre; **Ghana** (Gbe, Waci): Tɔslwɛn; **Ghana** (Gen): Aditi; **India** (Assamese): Matikanduri Sak; **India** (Bengali): Sanchi, Khenchi Shak, Nunia Shak; **India** (Chhattisgarh, Kotni, Paharikorba): Matyasaki; **India** (Gujarati): Jalajambo, Pani Ni Bhaji; **India** (Hindi): Gudrisag, Garundi, Jal Jimbua, Guru Bhaji, Kanchari; **India** (Jharkhand, Sahebganj): Sarauchi; **India** (Kannada): Honagone Soppu, Nasarchang; **India** (Malayalam): Meenamgani, Ponnankanni Keeray; **India** (Manipuri): Phakchet; **India** (Marathi): Kanchari, Laanchari; **India** (Odisha, Odia): Madaranga Saga; **India** (Sanskrit): Mathsyashikhi, Mathsyaakshi, Gidjihra, Giojihra, Matsyaksi, Lonika, Meenaakshi, Putthur; **India** (Tamil Nadu, Tamil): Ponnankanni, Koduppai; **India** (Telugu): Madanaganti, Ponnaganti Kura; **India** (Tulu): Ponnāṅkaṇṇi, Vaṇaṅṅana; **India** (Urdu): Atuli; **Indonesia** (Bahasa Indonesia): Daun Tolod, Krokot, Krema, Bayam Putih, Daun Rusa, Sayur Udang; **International** (Dutch): Garnalenmoes; **International** (French): Brede Chevrette, Magloire; **International** (Mandarin): Mau-t'ien-hsing, Lian Zi Cao, Bai Hua Zi; **International** (Portuguese): Alternantera Séssil, Bredo-D, Periquito-Sessil, Perpétua; **International** (Swahili): Mchicha; **Japan** (Japanese): Tsurunogeito; **Malaysia** (Malay): Keermak,

Bayam Pasir, Rumput Aur, Keremah Bukit, Kerak-kerak Paya; **Nepal** (Nepali): Bhiringi Saag, Sarhanchi Sag, Bhiringi Jhar; **Nigeria** (Hausa): Māi kāi dībūtū; **Nigeria** (Yoruba): Saje, Ewe Owo; **Pakistan** (Urdu): Kachari; **Palau** (Palauan): Okula Beluuledchad; **Philippines** (Filipino): Bunga-bunga; **Sri Lanka** (Sinhalese): Mukunuwenna; **Tanzania** (Swahili): Mkwese; **Thailand** (Thai): Phakpet Khaao, Phakpet Thai; **Tonga** (Tongan): Fisi'i'anoa; **Vietnam** (Vietnamese): Rau Dệu; **Zambia** (Chitonga): Mkungira.

Conservation value:

Least Concern - LC (IUCN, 2025)

Distribution:

The natural range of this species includes tropical and subtropical Asia, northern and eastern Australia, southern Mexico, and tropical America. It has been introduced to most African countries, with exceptions including Morocco, Libya, Eritrea, Somalia, Lesotho, Eswatini (formerly Swaziland), Madagascar, and Togo. It has also been introduced in Germany and Spain, Sri Lanka, New Zealand, and several south-eastern states of the United States (POWO, 2025).

Habitat:

Alternanthera sessilis is a pioneer or ruderal species commonly found in disturbed wetland habitats, including floodplains, riverbanks, canals, ditches, ponds, and irrigation and water-storage tanks, especially in South and South-East Asia (Rojas-Sandoval and Acevedo-Rodríguez, 2014a; Lucid Central, 2014b). It also occurs in marshes, swamps, low-lying moist ground, ephemeral pools, and forest edges (India Biodiversity Portal, 2024). The species thrives in human-altered sites such as abandoned fields, rice paddies, roadside depressions, paths, gardens, and plantations (Lucid Central, 2014b). It tolerates both wet and relatively dry conditions, growing along roadsides, ditch banks, and cultivated fields (Rojas-Sandoval and Acevedo-Rodríguez, 2014; EPPO, 2025c). *A. sessilis* is a common weed in agricultural systems across Africa and Asia. In Nigeria, it infests maize, while in the DRC it is found with crops like sorghum, millet, *Eleusine* spp., cotton, cassava, and groundnuts. In the Philippines, it occurs with tobacco, vegetables, and dryland crops (Ampong-Nyarko and De Datta, 1991; Rojas-Sandoval and Acevedo-Rodríguez, 2014). Ecologically flexible, it grows on various soils—from poor sands and alkaline substrates to loams and heavy black cotton soils. It can tolerate brackish or estuarine conditions near coastlines, though it prefers freshwater habitats (Lucid Central, 2014b; Rojas-Sandoval and Acevedo-Rodríguez, 2014a). Due to its adaptability and wide distribution, *A. sessilis* is not considered threatened and is listed as Least Concern (EPPO, 2025c; IUCN, 2025).

Invasiveness:

Alternanthera sessilis is a widely distributed pantropical species native to Central and South America, Asia, and Oceania. According to the Global Invasive Species Database (GISD, 2025c), it has naturalised in multiple countries across Asia, Africa, the Americas, and Oceania, predominantly in disturbed wetland and riparian habitats. The species reproduces both sexually by seeds and vegetatively via stem fragments, enabling rapid colonisation of suitable moist environments. While *A. sessilis* is less aggressive than *Alternanthera philoxeroides*, it is recognised as a moderate invader causing localised impacts, especially in agricultural irrigation systems, rice paddies, and other wetland crops (EPPO, 2025c). It was included on the EPPO Alert List as of 2019 due to its potential risk for European agriculture and the environment, although its current distribution in Europe remains limited (EPPO, 2019). Regionally, *A. sessilis* is noted as a weed of concern in humid and tropical areas such as the south-eastern United States and parts of Australia, where it is subject to monitoring and management to prevent its spread (EPPO, 2019; UF IFAS, 2023). Its invasiveness is linked to its tolerance of waterlogged conditions, phenotypic plasticity, and ability to establish in disturbed and man-made habitats. However, unlike

some highly invasive species, *A. sessilis* generally does not form dense monospecific mats, and its ecological impacts are mostly localised.

Ethnobotany:

Cultural and traditional uses: *Alternanthera sessilis* is a distinctive species in terms of the number of traditional uses among different cultures. In Benin, the plant is consumed year-round as a leafy vegetable. Its leaves are harvested from the wild and sold in local markets. Among ethnic groups such as the Adja, Fon, and Sahouè, it is usually precooked and incorporated into sauces and other dishes (Achigan-Dako et al., 2010; Sanoussi et al., 2015). Similarly, in Odisha, India, the soft tips of the top shoots are harvested by local people allowing the plant to survive while providing a steady supply of green leaves for further culinary use (Misra et al., 2012).

In Andhra Pradesh, India, the leaves of *A. sessilis* are valued for their cooling properties. They are considered a blood purifier and are often served as an ingredient in curries (Rao and Sreeramulu, 1985). The tender shoots of *A. sessilis* are also regularly consumed in Sahebganj, Jharkhand, by tribal communities, including the Santhal, Munda, Kharwar, and Oraon (Kumar and Kumari, 2021). In Sri Lanka, *A. sessilis* is commonly added to rice gruel, mixed with grated coconut and onion for salads, or served with rice and curry (Waisundara, 2019).

There are many documented uses of *A. sessilis* in traditional medicine. In Benin, the plant is used to treat a number of ailments, including dysentery, nosebleeds, haemoptysis, haematochezia, urethritis, mastitis, and painful urination. The laxative properties of the plant are widely recognised among the Fon and Mahi communities, where it is used to relieve indigestion, and constipation. The Sahouè ethnic group, on the other hand, uses it to treat anaemia. Among the Adja, the plant is valued for its anti-inflammatory properties and is used to cauterise infant navels. In addition, it is

known for its antiseptic properties and is therefore commonly used to treat wounds, sore throats, and abscesses (Sanoussi et al., 2015, Xu et al., 2020b). The Malayali tribes of the Kolli Hills in Tamil Nadu use the juice extracted from the plant's stems and leaves to counter snakebite (Kadirvelmurugan et al., 2014; Lokhande, 2020).

Medicinal uses of *A. sessilis* in different regions of India are also numerous. In Tamil Nadu, the plant is used to treat nervous disorders and headaches. Moreover, the juice of its leaves, when mixed with boiled cow's milk, is consumed to improve eyesight (Balakrishnan et al., 2009; Thirumalai et al., 2009; Jenifer and Lekha, 2019). In West Bengal, the whole plant is made into a paste and used as a poultice for skin diseases. Internally, it is used for fever, diarrhoea, and liver ailments (Chakraborty and Duary, 2014). Similarly, in Kerala, the plant has been traditionally used for respiratory and liver diseases, and its properties have been linked to its antidiabetic, anti-ulcer, and wound-healing potential (Sukhadev et al., 2022).

In Bangladesh, the fresh juice of *A. sessilis* leaves is consumed with honey to lower body temperature and treat leucorrhoea, while cooked leaves stimulate bile secretion, contributing to overall gastrointestinal health (Panda and Misra, 2011). In Pakistan and Nepal, the plant is consumed in herbal decoctions for both febrile conditions, and menstrual disorders, illustrating its wide range of uses in traditional medicine (Ahmad et al., 2016; Bhatt and Kunwar, 2020).

In addition to India, the plant has an important place in traditional medicine in other regions as well. In China, it is used in herbal preparations for its detoxifying properties, treating conditions such as jaundice, toothache, dysentery, and constipation (Li et al., 2017). In Mozambique, it is used as an abortifacient, antipyretic, and choleretic. It is also used in ophthalmic treatments (Sitoe, 2020). In Nigeria, *A. sessilis* is used to treat asthma, lung infections, liver disease, leprosy, and as an antidote to snakebites (Bello et al., 2023).

The use of *Alternanthera sessilis* is also heavily influenced by local beliefs. In Benin, certain groups, such as disciples of the deities Hêviosso, Tron, and Djaguidi, as well as parents of 'Agossou' - abnormally born children (e.g., head down), are forbidden from consuming this plant (Sanoussi et al., 2015).

Scientific perspective: *Alternanthera sessilis* is a very nutritious plant. It contains significant amounts of protein (18.19 g), vitamin C (32.28 mg), carotene (82.53 mg), dietary fibre (52.35 g), iron (95.74 mg), and calcium (2448.53 mg) per 100 g dry weight (Xu et al., 2020b). In addition, it is a valuable source of bioactive compounds such as lupeol, β-carotene, and vitamin C. These nutrients and compounds have been linked to galactagogue properties, reported to increase lactation in breastfeeding mothers, as well as its ability to stimulate bile flow (Misra et al., 2012; Saroya, 2013).

The phytochemical composition of *A. sessilis* includes phenols, saponins, flavonoids, tannins, epigallocatechin, catechin, chlorogenic acid, apigenin, and quercetin. These compounds are associated with antioxidant, anti-inflammatory, and wound-healing properties. Gas chromatography–mass spectrometry (GC–MS) analysis of the

stems identified methoxy-bis(cyclopentadiene) and other compounds with potential anti-asthmatic and antioxidant effects (Ahmad et al., 2016; Waisundara, 2019; Arya et al., 2022). In addition, triterpenes such as oleanolic acid and triterpene saponins are reported to block calcium channels, relax smooth muscle, and interfere with calcium permeability in parasitic worms, conferring antiparasitic properties on the plant (Wiart, 2020).

Methanol and acetone extracts of *A. sessilis* exhibit strong antioxidant activity. These properties are particularly beneficial in diabetic wound care and skin regeneration. The plant's anti-inflammatory effects include suppression of pro-inflammatory mediators and cytokines by inhibiting inflammatory pathways (Waisundara, 2019; Arya et al., 2022). *A. sessilis* also exhibits hypoglycaemic and analgesic properties, which further correlate with its traditional use for blood-glucose control and pain reliever. It is also worth noting that extracts from this plant have been reported to show cytotoxic activity against breast and colon cancer cell lines (in vitro) (Waisundara, 2019; Arya et al., 2022). Another confirmed property of the plant is its antiparasitic potential. Ethanolic extracts (50 mg/mL) have been shown to paralyse *Haemonchus contortus* within four hours (Wiart, 2020). It can therefore be concluded that scientific research to date has largely confirmed the validity of the plant's widespread use in folk medicine.

Alysicarpus ovalifolius (Schumach.) J.Léonard

Family:
Fabaceae Lindl.

Synonyms:
Hedysarum ovalifolium Schumach., *Alysicarpus harnieri* Schweinf., *Alysicarpus paradoxus* Boivin ex Baill.

Vernacular names:
Bangladesh (Bengali): Pannata; **International** (English): Alyce clover, Oneleaf clover, Wire grass, Witchweed; **International** (Mandarin): Lian jia dou; **Japan** (Japanese): Nagaba-sasahagi; **Madagascar** (Malagasy): Avoko, Takotsifo-araika; **Malaysia** (Malay): Akar siliguri; **Nigeria** (Hausa): Gadagi, Gadaji'irehi; **Senegal** (Arabic): Sãkalli, Tigingilit harche; **Senegal** (Fula-Pulaar): Mbampt, Mbarapté, Mbamptu; **Senegal** (Manding-Bambara): Dogo kuani, So tiga, Sogo kuani; **Senegal** (Mandinka): Furu fato; **Senegal** (Tukulor): Bampto ngoro; **Sri Lanka** (Sinhala): Aswenna.

Conservation value: –

Distribution:
This species is native to much of tropical and subtropical Africa, the Indian subcontinent, and parts of the Arabian Peninsula. It has been introduced to parts of eastern Asia, northern and western Australia, and the south-eastern United States (POWO, 2025).

Habitat:
Alysicarpus ovalifolius is a drought-tolerant legume native to tropical Africa and South Asia, commonly found in dry grasslands, savannah woodlands, fallow cropland, roadsides, and rocky outcrops on sandy or loamy soils, typically at elevations of 65–900 m (Verdcourt, 1970; Hyde et al., 2025a). It occurs in seasonally dry climates with 200–600 mm of annual rainfall and is frequently associated with disturbed or degraded soils (Mannetje, 2002). In agricultural settings, it is often present in upland and rain-fed rice fields, particularly along field margins, bunds, and paths, where soils are well-drained and exposed to full sun. While not suited to permanently flooded paddies, it can be an early-season weed in non-flooded rice systems (Mannetje, 2002; JSTOR Global Plants, 2025). Outside its native range, *A. ovalifolius h*as become naturalised in tropical America and Asia, colonising ruderal habitats and urban waste areas, suggesting potential to become invasive under suitable conditions (Hassemer et al., 2017).

Invasiveness: -

Ethnobotany:

Cultural and traditional uses: *Alysicarpus ovalifolius* is mainly used in the traditional medicine of local communities in West Africa. In Niger, a decoction of the root is traditionally given to treat colic, and it is also considered a tonic and an aid to wound healing. Juice squeezed from the leaves is consumed as a remedy for jaundice (Quattrocchi, 2012). In W National Park, named after the shape of the Niger River, locals use the whole plant as a medicine to relieve fever (Hassane, 2008).

In Nigeria, *Alysicarpus ovalifolius* plays a significant role in the treatment of neuropsychiatric disorders, particularly depression. Above-ground parts of this plant are included in herbal mixtures to improve mood (Khan et al., 2021). A noteworthy traditional preparation, 'gadaga tea', is used in Kano State. There, it is credited with boosting energy and increasing general alertness (Khan et al., 2021). This tea is also common in northern Nigeria, where it is prepared both individually from *Alysicarpus ovalifolius*, and in combination with other plants. It is reported to help improve cognitive function, concentration and physical endurance. As such, it finds popularity among manual workers (John-Africa et al., 2021). In Senegal, moreover, the plant is traditionally used among Fulani and Mandinka communities primarily to treat minor wounds and inflammation (Burkill, 1985).

In addition to its medicinal uses, *Alysicarpus ovalifolius* is known as an important fodder crop, particularly in West Africa. The plant is widely recognised as a staple food for livestock in arid regions, especially in Niger and Nigeria. Its usefulness is evidenced by the fact that it is a fodder weed sold in rural markets in Niger as livestock feed (Geesing and Djibo, 2001). Outside Niger and Nigeria, its use as a forage crop is well documented in Mauritania and other regions of western tropical Africa, where it supports agro-horticultural systems and increases livestock productivity (Burkill, 1985).

Scientific perspective: *Alysicarpus ovalifolius* is an important fodder resource particularly because of its high protein content, which exceeds that of forages such as millet (Geesing and Djibo, 2001). The nutrient content of the plant varies across growth stage. At the stem elongation stage, it contains 175 g/kg crude protein (CP), 24 g/kg digestible protein (DP) and thus a feed unit (FU) of 0.70. At the flowering stage, these values increase to 182 g/kg CP, 35 g/kg DP and 0.75 FU. At the fruit development stage, on the other hand, the crude protein content decreases slightly to 138 g/kg, while digestible protein increases to 41 g/kg and FU reaches 0.80 (Geesing and Djibo, 2001). During the dry season (October to February), the straw retains its nutritional value, containing 52 g/kg CP, 94 g/kg DP and

an FU of 0.72, allowing continuous livestock maintenance during periods of forage shortage.

The phytochemical composition of *Alysicarpus ovalifolius*, as reported by John-Africa et al. (2021), revealed the presence of bioactive compounds that contribute to its potential medicinal benefits. During analysis, caffeic acid was identified as the dominant compound, accounting for 60.34% of the total extract, followed by 3.44% chlorogenic acid and 0.19% rutin (John-Africa et al., 2021). These compounds are known for their antioxidant properties.

Pharmacological studies have also confirmed the plant's potential to increase physical endurance and alleviate fatigue. Mice administered extracts of *Alysicarpus ovalifolius* showed improved endurance in swimming tests, indicating that the onset of fatigue symptoms was delayed. Furthermore, rotarod and four-leg hang tests showed increased coordination and muscle strenght. The plant's antioxidant properties have also been shown to alleviate exercise-induced oxidative stress (John-Africa et al., 2021).

Amaranthus blitum L.

Family:
Amaranthaceae Juss.

Synonyms:
Amaranthus graecizans var. *blitum* (L.) Kuntze, *Euxolus blitum* (L.) Gren., *Glomeraria blitum* (L.) Cav.

Vernacular names:
Argentina (Spanish): Ataco; **Azerbaijan** (Karabakh region): Qirmizi pencer; **Brazil** (Portuguese): Caruru-folha-de-cuia, Caruru-vermelho; **Ecuador** (Pre-Kichwa): Ataco; **Ecuador** (Spanish): Amaranto bledo, Bledo; **Egypt** (Arabic): Filaklab; **Gabon** (Fang): Folo; **Greece** (Greek): Amaranthos to vliton, Vlito; **Hungary** (Hungarian): Zöld disznóparéj; **India** (Hindi): Bashpaka, Chilakarive, Giraka saale, Handi keere, Kiranga saale, Maath, Marisha, Marsha, Paandavar harive, Pokalbhaji, Rantandurja, Shandalio; **India** (Kashmiri, Gujjar, Dogra, Pahari): Gan, Ganhar, Kanhaar, Rata; **India** (Marathi/Maharashtra): Tandulja; **India** (Tamil): Keerai, Pitunkirai, Pitunkukirai, Ventantukkirai; **Indonesia** (North Sumatra, Bulumario Village): Bayam kotok; **Iran** (Persian): Baqlehyamanieh, Sefid-marz; **Israel** (English): Blite; **International** (Danish): Pletamarant; **International** (Dutch): de kleine Amaranth, het gemene Mayer, kleine majer; **International** (English): Blite, Guernsey pigweed, Least amaranth, Livid amaranth, Mediterranean amaranth, Purple amaranth, Slender amaranth; **International** (French): Amarante blette, Amarante livide, Amarante sauvage, Amaranthe blette; **International** (German): Aufsteigender Amaranth, Aufsteigender Fuchsschwanz, Bläulicher Amaranth, Grünlicher Fuchsschwanz; **International** (Italian):

Amaranto blito, Amaranto livido, Blitum; **International** (Mandarin): Ao tou xian, Niao xian, Qing xiang xian, Ye xian; **International** (Portuguese): Amaranto bredo, Bredo, Bredo-manso, Caruru-folha-de-cuia, Caruru-rasteiro, Caruru; **International** (Russian): Shchiritsa zhminda; **International** (Spanish): Amaranto bledo, Bledo, Yerba del moro; **Japan** (Japanese): Inubiyu, Hiyu, Hii, Fui; **Kenya** (Mau Escarpment): Mporociikc; **Korea** (Jeju Island): Gaebi-reum; **Malaysia** (English): India blite, Slender amaranth, Small slender amaranth, Tumbleweed; **Malaysia** (Mandarin): Niao xian, Qing xiang xian, Ye xian; **Malaysia** (Malay): Bayam, Bayam betul, Bayam itik; **Middle East** (Arabic): Baqla Yamānia; **Nepal** (Newar): Bakacha, Latte; **Peru** (Quechua): Ataco, Ataqko, Ataqo, Atakku; **Poland** (Polish): Szarłat siny, Szczyrzyca, Wasilki, Żminda; **Romania** (Romanian): verde; **Sweden** (Swedish): Mallamarant; **Turkey** (Turkish): Dari mancari, Hosmerik, Hoskuran, Ohrasan, Tilki kuyruğu; **Yemen** (Arabic): Annass, Dhadah, Gana, Ladah.

Conservation value: –

Distribution:

The native range of this species extends from Peru eastwards to Brazil and south to northern Argentina. It has been widely introduced and is now naturalised in tropical, subtropical, and some temperate regions, including parts of North and South America, Africa, Asia, Europe, and Oceania (POWO, 2025).

Habitat:

Amaranthus blitum thrives predominantly in human-disturbed, synanthropic environments such as waste ground, roadside verges, cultivated and fallow fields, gardens, and other ruderal sites, especially in dry, fertile soils with full-sun exposure (Go Botany, 2025; Lucid Central, 2025b). The species typically grows at low- to mid-elevations (0–1,000 m a.s.l.; Mosyakin and Robertson, 2020a). It prefers well-drained, eutrophic soils, often with a slightly alkaline pH, and is typically absent in shaded or waterlogged habitats (Go Botany, 2025). Although not a characteristic weed of flooded rice fields, it may occur in upland or dry-field rice systems and along margins or bunds, especially where soils are non-flooded and exposed to direct sunlight (Iamonico, 2013; Lucid Central, 2025b).

Invasiveness: –

Ethnobotany:

Cultural and traditional uses: *Amaranthus blitum* is a species commonly eaten as a leafy vegetable in many traditional culinary cultures. In South America, from which *A. blitum* originated, it is used in salads or added to stews. Its seeds, by contrast, are ground into porridge and tarts (Rapoport et al., 2009). The leaves as an ingredient in stews have gained particular popularity in Ecuador. In Brazil and Argentina, they are eaten raw, although they are also sometimes used as an ingredient in cooked meals (de la Torre et al., 2008; Barboza et al., 2009).

The leaves of *A. blitum* are also consumed in fried or cooked form in Africa. For example, people living in Kenya's Mau Escarpment region traditionally consume the plant after it has been fried with fat and served together with ugali (Owuor, 2021).

The people of the Karabakh region of Azerbaijan eat the leaves, seeds and shoots of the plant. The leaves are steamed or boiled and then served with olive oil, lemon and salt (Novruzov et al., 2023). In Nepal, among the Newar community, it is a key ingredient in dishes such as 'Kakachatarkari', in which it is mixed with other wild greens (Joshi, 2022). In Malaysia, *A. blitum* is cultivated and, consequently, is a popular ingredient in local dishes. It is prepared there by blanching, frying, or adding to soups and curries (Saidin, 2000; Amin et al., 2006). In southern China, *Amaranthus blitum* is consumed in the form of seedlings, young shoots and leaves, which are fried, used in soups or added to sauces. It is also used in egg pancakes and cooked dishes (Xu et al., 2020b).

A. blitum has been used since medieval times as a common vegetable in Europe as well, where it was added to soups, stews and a variety of vegetable

pulps. In Italy, it was historically included in vegetable mixtures, which are still consumed today in some regions (Guarrera and Savo, 2016). In Spain, *A. blitum* seeds are still used for flour-making (Pereira et al., 2020). Meanwhile, in Turkey, the flowering branches are cooked like spinach and used as a vegetable (Baytop, 1994).

Amaranthus blitum has also found extensive use in traditional medicine. In Peru, the plant is used to treat colic, jaundice and nephritis, while also serving as a diuretic and detoxifier (Delgado Súmar, 2018-2019). In both Brazil and Portugal its heated leaves are used as poultices to treat cancer (Ferrão and Liberato, 2015).

Moving to Asia: in Jordan the seeds are used in traditional medicine to treat fever, diarrhoea and dysentery (Handa et al., 2006). In India's Buldhana district, it is used as a treatment for haemorrhoids, snakebites and menstrual disorders (Sirsat et al., 2024), while in Maharashtra, the juice of the leaves is consumed along with sugar for eye diseases (Beldar and Sidat, 2020). Traditional Chinese medicine practitioners use *A. blitum* to treat dysentery and, as in previous cases, eye inflammation and haemorrhoids (Xu et al., 2020b).

The plant is also used in belief-based rituals. People living in Jammu and Kashmir use the powdered seeds of *A. blitum* for protection against black magic. These seeds are also burned to produce smoke to protect livestock against harm from supernatural powers (Haq et al., 2022).

In Persian medicine, *Amaranthus blitum* has been extensively documented in the Canon of Medicine by Avicenna. According to the humoral theory then in use, he described this plant as cold and moist in the second degree, along with higher-moisture-content vegetables such as white pumpkin and lettuce. Although the plant was not considered highly nutritious, it was valued at the time for its cooling and soothing properties (Ibn Sina, c. 1025).

For centuries, *Amaranthus blitum* in Europe played a key role as a source of food during periods of famine and war. In the 16th century, European botanists such as Fischer-Benzon recorded the cultivation of *Amaranthus blitum* and related species (*Blitum virgatum*), often grouping them with 'spinaches', which in turn led to historical confusion in their scientific nomenclature (Maurizio, 1926).

Scientific perspective: *Amaranthus blitum* is known for its high nutritional value. The plant is a rich source of calcium (1527.38 mg/100 g dry weight), iron (52.77 mg/100 g dry weight), dietary fibre (53.04 g/100 g dry weight) and vitamin C (56.49 mg/100 g dry weight) (Xu et al., 2020b). Also noteworthy is the plant's high carotenoid content of 24.7 mg per 100 g, including 6.0 mg/100 g dry weight of β-carotene, which may have positive effects on vision and skin health (Rajyalakshmi et al., 2001; Rapoport et al., 2009). In addition, *A. blitum* seed oil is rich in bioactive compounds including the triterpenes β-amyrin and lupeol as well as fatty acids such as linoleic, myristic, oleic and palmitic acids (Barboza et al., 2009).

Scientific studies have demonstrated the high antioxidant potential of *Amaranthus blitum*. However, it is worth noting that blanching the rapidly reduces its antioxidant capacity (Amin et al., 2006). Red varieties of *A. blitum* contain anthocyanin pigments, which further increase their antioxidant potential. Studies indicate that regular consumption of this plant in salads is associated with reductions in oxidative stress, blood pressure and cholesterol levels (Pereira et al., 2020). In addition, extracts from the plant have been shown to improve liver function markers, including alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), and bilirubin levels (Yılmaz, 2010). The plant has been reported to have antimicrobial properties due to the presence of phenolic compounds and betalains, which exhibit antimicrobial activity (Baraniak and Kania-Dobrowolska, 2022).

Amaranthus spinosus L.

Family:
Amaranthaceae Juss.

Synonyms:
Galliaria spitosa (L.) Nieuwl., *Amaranthus caracasanus* Kunth, *Amaranthus coracanus* Mart., *Amaranthus diacanthus* Raf.

Vernacular names:
Argentina (Spanish): Atáko espinádo, atáko espinúdo; **Australia** (English): Needle burr; **Bahamas** (English): Calalù, spiny amaranth; **Bangladesh** (Bengali): Katanáta, kata noté; **Benin** (Bariba): Gàatam migàatɛ; **Bolivia** (Spanish): Chióri espinóso, játako; **Brazil** (Candomblé): Tété gún; **Brazil** (Portuguese): brédo-bránco, brédo-brávo, brédo-de-espínho, brédo-de-santo-antônio, brédo-vermelho, carurú, carurú-brávo, carurú-de-espínho, carurú-de-pórco; **Cambodia** (Khmer): Ptí banlá; **Cameroon** (Ewondo): Éwèlɛ̀ a mùŋángà; **Caribbean** (English): Kalálù; **Côte d'Ivoire** (Guere): Nionzán, Békiblé; **Côte d'Ivoire** (Kru-Grebo): Bédié; **Cuba** (Spanish): Blédo espinóso; **El Salvador** (Spanish): Blédo, bléro, huisquilíte; **Ethiopia** (Amharic): Alúma, ferenjáluma; **Ghana** (Adangme): Anágo mío; **Ghana** (Akan-Akyem): Nantwí nkáse; **Ghana** (Asante): Asantewá; **Ghana** (Ewe/Vhe): Matóŋui, Sɛnutsœ́e, Ámma, Awúsagbè, Awúsatsó; **Ghana** (Ga): Slahá-ŋméi; **Ghana** (Twi): Asíbe, Esíbe, Nantwí bin, Srahá nkáseɛ, Srahá nsoé; **Guadeloupe and Martinique** (French Creole): Zépinard-piquant, Épinard-rouge, Zépinard-cochon, Zépinard-cabrit; **Guinea** (Kissi): Fondoló-úngu; **Guinea** (Kpelle): G-bó; **Guinea** (Loma): Pélé uluzédikolé; **Guinea** (Mandingo/Maninka): Bulunónima; **Guinea-Bissau** (Portuguese): Brédo; **Haiti** (French): Épinár piquárd, épinár sauvágé, zépinár piquánt; **India** (Gujarati): Ádak-dhatúra; **India** (Hindi): Alpamárish, alpamarísha, bhándi, bhándira, cholái, katailí, katailí chaulí, kantaneutiá, kántá chaulái, kánté math; **India** (Oriya/Tamil): Mullikkirái; **Indonesia** (Bahasa Indonesia): Báyam éri, báyam durí; **Indonesia** (Javanese): Báyem cíkron, senggáng cúcuk; **Indonesia** (Sundanese): Bájem durí; **International** (English): Spiny amaranth, spiny pigweed, carelessweed, edlebur, needlebur, pigweed, prickly amaranth, prickly calalu, Prince-of-Wales-feather,

thorny amaranth, thorny pigweed; **International** (French): Amaránte épineúse, amaránth épineúse, blétte épineúse, épinár cochón, épinár malábre, épinár piquánt; **International** (German): Amárant, dórniger Fúchsschwanz, Malábarspinat; **International** (Mandarin): Ci xian, pala; **International** (Portuguese): Brédo-brávo, brédo-de-espínho, carurú-brávo, carurú-de-espínho; **Japan** (Japanese): Háribiyu; **Kenya** (Swahili): Katilá; **Lesser Antilles** (French Creole): Zépinná wój; **Malaysia** (Malay): Báyam durí, báyam hután; **Mauritius** (French Creole): Bréde malábar a piquánts, oseílle, petít trefle, tréfle; **Mexico** (Spanish): Quelíte, quintoníl de búro, quintoníl espinóso, alegría, amaranto, quelite de puerco, quelite de marrano, quelite de burro, quelite ceinizo, quiltonil espinoso, quintonile espinoso, espina, espina de borrego, cosquelite, bisquelito blanco; **Myanmar** (Burmese): Hin-nu-nivé-tsu-báuk, tsu-gyí; **Nepal** (Nepali): Bagáni dháp, bakán, bandání, banlundé, dhálya, kandé, lundé; **Nicaragua** (Spanish): Auia kiaka, espina de la playa; **Nigeria** (Fula-Fulfulde): Haáko ndíyam; **Nigeria** (Hausa): Rukúßu, Cílli, Námijìn gaásàyaá, Námíjìn-zaákií-bánzaá; **Nigeria** (Igbo): Ìnìnè-ógwū; **Nigeria** (Yoruba): Ẹ̀fọ́ tètè, Tètè ègún, Tètè élèègún; **Peru** (Spanish/Quechua): Yúyo mácho, ataco, atacko, ataqo, attako, ataku, ataco casha, bledo, bledo espinoso, hierba de la horcada, rabo de gallo; **Philippines** (Filipino): Ákum, alayón, ayantóto, gítin-gítíng, kalítis, kalúnai, oráy, kulítis, tádtad; **Puerto Rico** (Spanish): Bléro espinóso; **Senegal** (Mandingo/Bambara/Serer/Wolof): Ngoroba blé, Dahd́ir gor, Mbum bu gor, Mbum i gor; **Sierra Leone** (Bulom/Sherbro/Kono/Mende/Temne): Bɛntisɔk-lɛ, Sɔndi, Hɔndi, Ta-hɔndi, A-bonthila, A-niŋkuna, A-senduku; **South Africa** (Afrikaans/Zulu): Doring misbredie, imbuya; **Spain and Latin America** (Spanish): Bledo espinoso, espinaca de Malabar, yuyo, ataco, hierba de la horcada; **Sweden** (Swedish): Taggamarant; **Tanzania** (Swahili): Bwasi; **Thailand** (Thai): Pak-khom-nam; **Venezuela** (Spanish): Pira brave; **Vietnam** (Vietnamese): Dén gai; **Zimbabwe** (Shona/Ndebele): Imbowa, mohwa-gura.

Conservation value: –

Distribution:

The native range of this species extends from Mexico throughout much of tropical America, including parts of Central and South America as well as the Caribbean. It has been widely introduced and is now naturalised across tropical and subtropical regions of Africa, Asia, Oceania, and the Americas, as well as parts of southern and temperate Europe and parts of the United States (POWO, 2025).

Habitat:

Amaranthus spinosus is a highly adaptable annual species that colonises a wide range of disturbed habitats in tropical and subtropical climates. It thrives predominantly in such habitats including agricultural fields (e.g., rice), roadsides, railways, overgrazed pastures, waste areas, and fallow land. *A. spinosus* tolerates variable moisture conditions, from dry to seasonally waterlogged soils, and generally prefers full sunlight, but can persist in partially shaded environments. It typically occurs from sea level to elevations of up to 1,800 m a.s.l depending on local conditions (Caton et al., 2010; Rojas-Sandoval, 2015a; Weed Herbarium BUET, 2023a, Fern, 2025; Mosyakin and Robertson, 2020b).

Invasiveness: –

Ethnobotany:

Cultural and traditional uses: *Amaranthus spinosus* plays an important role in traditional South American cuisine. In Argentina, the young leaves, stems, and inflorescences are eaten raw, boiled, steamed, or fried, added to stews, or fried after being coated in egg batter (Rapoport et al., 2009). *A. spinosus* is also used in traditional Mexican dishes such as *alegría*, *atole* and *tamales*. In addition, its leaves, known as *quelites*, are cooked with salt and eaten as a staple food by indigenous communities, including the Tarascans (Austin, 2006). These culinary traditions have persisted, particularly in Guerrero, Hidalgo, Oaxaca, Puebla, and Veracruz, where the leaves remain a common ingredient in local dishes (Casas and Blancas Vázquez, 2023). In Guatemala, *Amaranthus spinosus* is consumed as a cooked green, although less frequently than *Amaranthus hybridus*. The young shoots of various

Amaranthus species, including *A. spinosus*, are also sold in local markets as leafy vegetables (Instituto de Ciencia y Tecnología Agrícolas, 2023). The plant is also an important leafy vegetable in Jamaica, prepared similarly to spinach (Hedrick, 1919).

The leaves of *A. spinosus* have also found use in traditional African cuisine. They are added to soups or eaten raw in salads (Olaniyi et al., 2024). Among Miskitu-speaking communities in Nicaragua, however, the plant is not only used for food. Steam from cooking it is used for inhalation to relieve rheumatism (Barrett, 1994).

Amaranthus spinosus is found in widespread use in traditional medicine across South America. In Argentina, the plant is given as an infusion to treat fever and eczema. It is attributed with emmenagogic and galactagogic properties, as well as supporting menstrual health and lactation. The root is used to relieve menstrual bleeding, nervous tension, stomach ulcers and sexually transmitted infections, while the dried rhizome is consumed as an infusion for liver disorders. Its leaves are furthermore used topically for their emollient and anti-inflammatory effects (Barboza et al., 2009). Additionally, *A. spinosus* has found recognition in Peruvian herbal medicine for its antispasmodic, emmenagogic, and antiseptic properties. In this country, it is used to treat bladder complaints, fever, rheumatic pain and digestive disorders. In addition, its decoctions are used in traditional baths to reduce fever and externally to relieve gout symptoms (Charcape et al., 2010). In Colombia, the plant is used in decoction form as an anti-inflammatory and anti-haemorrhagic agent. Consequently, it is commonly recommended there as a remedy for the relief of abdominal pain and muscle cramps (Paniagua-Zambrana and Bussmann, 2020).

Moving on to Central America, in Mexico *A. spinosus* is valued primarily for its efficacy in the treatment of rheumatism, as well as for being a diuretic and aiding wound healing (Alonso-Castro et al., 2017). In Guatemala, the plant was traditionally used to treat skin lesions. However, during colonial

rule, Spanish authorities banned its cultivation and use due to its association deemed 'disordered' by colonial authorities (Atran et al., 2004).

Amaranthus spinosus has a wealth of uses in folk medicine throughout West Africa. It is used there for ailments such as eye and ear infections, stomach disorders, diarrhoea, dysentery, kidney problems, haemorrhoids, and sexually transmitted infections. Additionally, it is used to regulate the menstrual cycle and increase lactation. Traditional birth attendants in Senegal give *A. spinosus* postnatally to the mother and later to the infant for stomach complaints (Burkill, 1985). Similarly, in Gabon, baths containing the leaves of the plant are prepared for new mothers about a month after birth (Burkill, 1985). In Nigeria, the plant is used as a remedy for kidney ailments. For this purpose, an

extract is prepared by soaking the leaves in water or alcohol for two days (Kawade et al., 2013).

In Asia, Bangladeshi folk medicine uses the root of *A. spinosus* to treat dysentery and as a diuretic (Bari et al., 2017). Traditional Chinese medicine, in turn, recognises *A. spinosus* for the treatment of diabetes. The seeds are used in poultices to treat bone fractures. The root, on the other hand, is valued for its strong diuretic effect (Kawade et al., 2013). A decoction of the root, moreover, is administered throughout South-East Asia as a remedy for gonorrhoea. It has also found recognition as an emmenagogue and antipyretic. Among tribal communities in Kerala, India, the juice of *A. spinosus* is consumed to relieve flatulence. Boiled leaves, consumed two to three days, without salt, are also believed there to cure jaundice. Cases are also known from Nepal and some regions of India that the pland has also been used locally as an abortion inducer (Kawade et al., 2013).

In Candomblé, an Afro-Brazilian religion rooted in Yoruba traditions, *Amaranthus spinosus* is sacred to Exu, an orisha (deity) of intersections, communication, and transformation. Exu governs the crossings, requiring rituals that balance energies, protect, or 'open pathways'. The plant's spiny morphology symbolises protection, acting as a barrier against the forces of evil. The plant is used to purify and consecrate ritual tools, is part of offerings to Exu placed at crossroads, cemeteries, or at doorways, and acts as an amulet to protect against misfortune (Jagun 2017).

Referring to the historical use of *A. spinosus*, we know that the Aztecs valued this plant not only as an important food source but, as in the case of the Yoruba people, a sacred element of religious rituals. Its seeds were part of ceremonial offerings during the Toxcatl festival, held in honour of the god Tezcatlipoca (Austin, 2006). The plant's historical utilitarian properties can also be encountered in folk nomenclature. In El Salvador, for example, the plant is called *Huisquilite*. This name has Aztec linguistic roots and means 'spiny *quelite*'. The term *quelite*, in turn, is widely used in this part of the continent to describe various edible potherbs (Standley, 1931).

Scientific perspective: *Amaranthus spinosus* leaves contain high amounts of carotenoids and β-carotene, which may contribute to its cultural importance in supporting visual health. In addition, the leaves provide minerals such as calcium, potassium, iron, copper, zinc, manganese, and molybdenum (Rapoport et al., 2009) Studies of the chemical composition of *A. spinosus* have revealed a high diversity of substances may underpin its reported medicinal properties. Chemical analyses have identified the presence of leucine, alanine, phenylalanine, arginine, nicotiflorin, and oxalate oxidase, which are associated with metabolic and immune functions (Barboza et al., 2009). Additionally, the presence of gallic acid, caffeic acid, ferulic acid, p-coumaric acid, and quercetin contributes to the antioxidant potential of the plant (Guria et al., 2014; Kongdang et al., 2021).

Ethanolic and aqueous extracts of *A. spinosus* have shown antimicrobial activity against Gram-positive and Gram-negative bacteria. They have also been shown to inhibit carrageenan-induced oedema and reduce acetic-acid–induced vascular permeability, supporting the plant's anti-inflammatory activity. In the treatment of pain, the plant extract reduced abdominal cramps in acetic acid-induced writhing tests, supporting its analgesic potential and confirming the validity of using the plant for this purpose in folk medicine (Guria et al., 2014). Studies on the polyphenols in the plant have shown their interaction with the intestinal microbiota, leading to the formation of metabolites that support intestinal-barrier function, modulate microbial composition, and improve gastrointestinal health (Kongdang et al., 2021).

Amaranthus viridis L.

Family:
Amaranthaceae Juss.

Synonyms:
Euxolus viridis (L.) Moq., *Glomeraria viridis* (L.) Cav., *Pyxidium viride* (L.) Moq., *Albersia caudata* (Jacq.) Boiss.

Vernacular names:
Angola (Portuguese): jimboa/jinboa; **Argentina** (Spanish): ataco, bledillo, caruru, chichimeca, citaco, yuyo colorado; **Benin** (French): amandjin; **Brazil** (Portuguese): amaranto-verde, bredo, bredo-de-porco, caruru, caruru-branco, caruru-bravo, caruru-de-mancha, caruru-de-porco, caruru-de-soldado, caruru-manso, caruru-miúdo, caruru-preto, caruru-sem-espinho, caruru-verde, caruru-verde-comum, caruru-verdadeiro, carurú-comum; **Central America** (Spanish): bledo chino, calabo; **Colombia** (Spanish): bledo manso, bledo verde; **Congo** (Local): bambo/bamboo, dunda, kwelekwele, lenga-lenga, livanga, lonenge, m'bowa, mobela, mocumbe, mofoto, munana, nadily-m'puluka, porio, poto; **Côte d'Ivoire** (Akan-Asante): famufuéué, fankokoré; **Czech Republic** (Czech): laskavec zeleny; **DR Congo** (French): amarante verte, épinard vert, épinard du Congo; **Ethiopia** (Amharic): passa; **Fiji** (Fijian): choraiya; **Finland** (Finnish): hentorevonhanta; **French Antilles** (French): épinard marrom; **Ghana** (Akan-Asante, Dagbani): boboroa, ɛfan; **Guinea** (Mandinka-Maninka): boromonema; **Guinea-Bissau** (Crioulo, Fula-Pulaar): bredo, bórborò-dórò, bóròbórò-déo; **Guyana** (English): calalu, pira; **India** (Hindi, Tamil, Telugu, Kannada, Malayalam, Sanskrit): chaulai, chilaka thota koora/chilaka-thotakoora/chilakathotakura, cheakeerae soppu, chuli, chuolae, cilakiresoppu, dagglarive soppu/dagglisoppu/dagli-soppu, fara, gandira, ghinar, gojha, hilamochaka, iruvati, iruvatikkirai, jangli chaulai/jangli-chauli, keere soppu/kiresoppu, kollaikkirai, koshala, kullattantukkirai, kundru, kuppacheera, kuppai-kirai, kuppaikkirai, lahanamat, marsu, matla, mullancira, niccatakkirai, niccatam, peyppalati, peyp-palatikkirai, ran-bhaji, siru keerai, tanduliya, tanduliyah, tanduliyaka, tendula, vakucakkirai, vishaghna, wild amaranth;

International (English): African spinach, calalu/callaloo, green amaranth, green pigweed, local tete, pigweed, Prince of Wales feather, rough pigweed, slender amaranth, spinach amaranth, wild amaranth; **International** (French): amarante verte, épinard du Congo, épinard vert; **International** (German): amarant, fuchsschwanz, gruner amarant, liegender; **International** (Mandarin): báixiàn, lǜ xiàn, xiàn cài, yě xiàn, yě xiàn cài/ye xian cai, zhou guo xian; **International** (Portuguese): bredus, cararu; **International** (Spanish): bledo colorado y blanco, bledo sin espinas; **Jamaica** (Patios): callaloo; **Japan** (Japanese): aobiyu, honaga-inubiyu, nagabo-biyu; **Malaysia** (Malay): bayam munyet, bayam pasir, bayam putih; **Mali** (Bambara, Fula-Pulaar, Songhai, Tamachek): nafa-nafa, nporon ngonintan, tazelanghatai, walia bocio; **Mexico** (Spanish): quelite blanco, quintoline; **Nepal** (Nepali): bagani dhap, chikli, gandri, ganheri, kantiya, katageni, latte, longe sag, lude, lunde, lunde jhar, mate, matiys sag, morche sag, rangan, ranghya, seto lunde; **New Zealand**

(Māori): tupu'a; **Nigeria** (Fula-Fulfulde, Hausa, Igbo, Ijo-Izon, Kanuri, Yoruba): haako-ndiyam, ìnìnàḭ́n, ìnìnè ófĩá óló, ìnìnèmbeèwú, ìnìnèmmẽ, ìnìine ójíĩ, lekir, lábàshií, malan kochi/malan-kotshi, memomene, námíjìn-gaásàyaá, námíjìn-zaákií-bánzaá, níníyà, rukußu, rukußuho, rùb-dátúkúnyá, soko, taatsunyaa, tete-abalaye, tẹ̀tẹ̀, tẹ̀tẹ̀ àtètèdáyé, tẹ̀tẹ̀ kékeré, tẹ̀tẹ̀ atẹle danji, zaákiíbánzaá, zaki banga, zaki banza, zarangade; **Pakistan** (Urdu): babara, cerucira, chalveray, chalwai/chalwayi, chaulai, cholai, dhimdo, ganhar, ghinari, ghunar, gunhar, jao sag, jangli chalai, ranzaka/ranzakka, soba; **Paraguay** (Guaraní): caruru moroto, kaa ruru; **Philippines** (Filipino, Tagalog): colites, culilis; **Poland** (Polish): szczyrzyca; **Puerto Rico** (Spanish): blero, bledo manso, lumboo; **Senegal** (Serer, Wolof): dahd́ ir, mbum bu digèn, mbum bu levet, mbum i kör; **Sierra Leone** (Bulom Sherbro, Kono, Mende, Temne): a-niŋkuna, an-senduku, bɛntisɔk-lɛ, hɔndi, sɔndi, ta-hɔndi; **South Africa** (Zulu): imbuya; **Sri Lanka** (Sinhala): Chinese spinach, koora thampala, pigweed; **Sweden** (Swedish): smalamarant; **Thailand** (Thai): phak khom; **The Gambia** (Diola Fogny): ébayibadjay; **Togo** (Gurma Mango): boboroa; **Tonga** (Tongan): tupu'a; **Turkey** (Turkish): silmastik; **Ukraine** (Ukrainian): shchiritsya zelena; **Venezuela** (Spanish): pira blanca; **Vietnam** (Vietnamese): den com.

Conservation value: –

Distribution:

The native range of this species extends from south-eastern Mexico throughout much of tropical America, including Central and South America as well as the Caribbean. It is naturalised in a wide range of tropical and subtropical regions worldwide, and has also been introduced to parts of temperate Europe, Asia, North America, Africa, and numerous oceanic islands (POWO, 2025).

Habitat:

Amaranthus viridis predominantly occupies disturbed and synanthropic habitats, including waste ground, roadsides, cultivated and fallow fields, railways, lawns, gardens, and urban environments. The species thrives on well-drained, fertile soils ranging from sandy to loamy textures and prefers full sun exposure. Ecologically, *A. viridis* is adapted to warm climates with moderate rainfall, but it also tolerates drought and nutrient-poor soils, demonstrating broad ecological plasticity. It is commonly found at low to mid elevations (0–1,500 m), frequently colonising ruderal and agricultural landscapes. In cropping systems, *A. viridis* often appears as a weed in upland and rainfed rice fields in many Asian countries, particularly along field margins and bunds where the soil remains non-flooded (Chauhan and Johnson, 2017; Mosyakin and Robertson, 2020c; Weed Herbarium BUET, 2023b; Fern, 2025; Flora of Greece, 2025; JSTOR Global Plants, 2025)

Invasiveness –

Ethnobotany:

Cultural and traditional uses: *Amaranthus viridis* is a plant that is used among cultures on different continents. In Africa, the plant is an important part of the local diet in Akure South Local Government Area in Ondo State, Nigeria (Olowo et al., 2022). The Konso community in Ethiopia values its young shoots, which are cooked and eaten (Eshete et al., 2016). The situation is similar in Angola, where *Amaranthus viridis* was consumed along with other plant species of its genus (Hiern and Welwitsch, 1896). In India, the tender shoots of *Amaranthus viridis* are also eaten as a vegetable (Tsering et al., 2017). In Pakistan, the plant is prepared as *saag*, a traditional leaf-based dish (Abbasi et al., 2015). In Turkey, the leaves are eaten fresh or added to egg and vegetable dishes (Polat et al., 2015). On the island of Puerto Rico, the plant is not only used as a vegetable, but also as fodder for poultry, pigs and cattle (Núñez Meléndez, 1982). *Amaranthus viridis* is used in traditional Brazilian cuisine similarly to spinach. Its leaves and young stems are cooked, which reduces the oxalate content. The ingredients cooked in this way are used to prepare vegetable paste, among other dishes (Khatounian, 1994). The

seeds of this species are also known as a source of nutrition in times of food shortage (Corrêa, 1984). In Argentina, the plant, known locally as 'ataco', is also used in traditional dishes. One of the uses is for the roots, which are sometimes ground and added to yerba mate (Scarpa, 2004). In the past, the Aztecs and Mayans cultivated *Amaranthus viridis* as a vegetable. The seeds, in particular, were eaten and used as a substitute for cereals. For this reason, the seeds are also known as 'Inca wheat' (Roth and Lindorf, 2002). Historically, *Amaranthus viridis*, known as 'bredus', was also a popular ingredient in traditional dishes in Portugal, where, as is still the case in Brazil, it was cooked in a similar way to spinach (Braune, 1797). The same was true in France, where its leaves were often included in meals, especially among the poorest members of society (Roucel, 1803).

In addition to its nutritional role, *Amaranthus viridis* also exhibits a wide range of medicinal purposes. In Nigeria, both the leaves and roots are used to treat snakebites. They are applied in the form of a paste, reported to alleviate the effects of the venom when put on the bite (Onuminya et al., 2018). In traditional Indian medicine, the plant is used for skin diseases, hallucinations, bronchitis, haemorrhoids, leucorrhoea and constipation (Yadav et al., 2018). Furthermore, it is used by the indigenous communities of the Andaman and Nicobar Islands to address asthma (Kamble et al., 2008). In Pakistan, *Amaranthus viridis* is known for its laxative effect. The powder from its dried leaves is used traditionally to treat gallbladder and kidney stones (Rehman et al., 2015). Other uses include applications for insect bites, malaria and the menstruation (Ajaib et al., 2015; Tufail et al., 2020). In Puerto Rico, the species is also used traditionally as an antispasmodic for dysentery. Moreover, its heated leaves are applied as a poultice to treat inflamed ulcers and skin irritations (Núñez Meléndez, 1982). Traditional medicine in Brazil employs *Amaranthus viridis* as a diuretic, demulcent, resolvent and laxative, particularly for oedema and cystitis (Lorenzi and Matos, 2021). It is also believed that the plant, when applied externally, promotes lactation and may help with eczema (Lorenzi and Matos, 2021). Furthermore, the infusion is commonly used for liver complaints (Le Cointe, 1947; Vieira, 1992). The whole plant is used to produce medicines to expel intestinal worms and for snakebite (Hoehne, 1978; Behari et al., 1986). In addition, 'ataco' is valued in Argentina for its diuretic properties. A decoction is therefore also used to address haematuria (Scarpa, 2004). In Mexico, *Amaranthus viridis* is used in women's traditional medicine, especially for the treatment of postpartum haemorrhage (Gheno-Heredia et al., 2011). Among the population of the Mexican region of Chiapas, the leaves are also used to treat indigestion and smallpox (Geck et al., 2016).

Amaranthus viridis also has other uses in local cultures. In Nigeria, it is known as an important forage plant and is therefore widely cultivated (Olowo et al., 2022). The plant is also used as feed for farm animals in Pakistan. This is the case, for example, in the Hazar Nao forest in Malakand (Murad et al., 2012). Similarly, in Puerto Rico, the plant is mainly cultivated as feed for poultry, pigs and cattle (Núñez Meléndez, 1982). In the context of ethnoveterinary medicine, the above-ground parts of the plant are used to prepare decoctions to treat haematuria in horses by the Criollo people in north-western Argentina (Scarpa, 2000)

Scientific perspective: *Amaranthus viridis* contains amino acids such as lysine, arginine, histidine and phenylalanine, making it a valuable dietary component (Ferdous et al., 2015). In addition, *A. viridis* is rich in vitamins A and C and contains minerals such as phosphorus, calcium and iron, as well as a significant amount of protein. Its seeds contain about 13% protein and 65% carbohydrates with values typically reported on a dry-weight basis. However, the oxalate and nitrate content can have negative effects, which should be taken into account when consuming large amounts (Roth and Lindorf, 2002).

Phytochemical research confirms that *A. viridis*

is rich in tannins, alkaloids, flavonoids, saponins and glycosides, all of which contribute to its antioxidant and antimicrobial properties. Studies on methanolic extracts from the leaves and seeds of this plant have reported antibacterial activity against *Staphylococcus aureus* and *Escherichia coli*, as well as antifungal activity against *Fusarium solani* and *Rhizopus oligosporus* in vitro (Ahmed et al., 2013). In addition, the plant contains various secondary metabolites, including cardiac glycosides, steroids and triterpenoids, which further increase its pharmacological potential (Ferdous et al., 2015). Therefore, the plant displays many therapeutic properties, including anti-inflammatory, hepatoprotective, antiulcer, antiallergic and antiviral effects. Moreover, its bioactive compounds, including quercetin, kaempferol and hydroxycinnamic acids (e.g., coumaric, ferulic, sinapic, caffeic, chlorogenic and rosmarinic acids), contribute to its antioxidant, antimicrobial, anti-inflammatory and anti-endotoxic effects (Kumar et al., 2022).

Ammannia baccifera L.

Family:
Lythraceae J.St.-Hil.

Synonyms:
Ammannia baccifera f. *genuina* Koehne, *Ammannia baccifera* f. *typica* Koehne, *Ammannia apiculata* Koehne, *Hapalocarpum indicum* (Lam.) Miq.

Vernacular names:
Bangladesh (Bengali): Dādmāri, Bānmārich, Pan-marich; **Benin** (Fon/Yoruba—unresolved): Worougboko, Worukoho; **India** (Assamese, Assam): Agnigarbha, Karna-sak; **India** (Dakhini): Agni-buti; **India** (Gujarati): Jālmukhī, Jalāgiyo, Jalavgiyo; **India** (Hindi): Aginbutī, Ban Mirich, Jangli mehndi, Dādmāri, Kuranda, Kuranta, Do-patti-ki-kanduri, Jal bhangro, Lal babusi, Mehudi, Lal Dana; **India** (Kannada): Kāḍugida, Agnivēndrapāku, Kallurivé, Agnivāti, Agnivaya; **India** (Konkani): Dādmāriyā; **India** (Malayalam): Kaḷḷuruvi, Kaḷḷur vañchi, Kallarvanchi, Nīrumēl neruppu; **India** (Marathi): Aginbutī, Bharajambhul, Dādmāri, Agrī butī, Agyo, Lalshirak; **India** (Meitei/Manipuri): Ishing kundo; **India** (Mundari): Garatulsi, Garaturusi; **India** (Oriya): Dādmāri, Rāmdāuni; **India** (Punjabi): Dādarbuṭī; **India** (Sanskrit): Agnigarbha, Brahmasoma, Kṣetrabhūṣā, Kṣetravāśinī, Pāṣāṇabheda, Mahāśyāma, Kurendika, Kuranti, Sukaranda, Vikata, Agnigarva, Kuranli, Davagni, Jalapushpi; **India** (Tamil): Nīrmēl neruppu, Kaḷḷuruvi, Kallūruanchi, Neruppu, Kallurivi, Kallur-vanchi, Cemaciya, Cilapetam, Cirukalluruvi, Ilavankappacitacceti, Ilavankappacitam, Kallarivi, Kallukkoti, Kalluppaikkatti, Kalluri, Kallurícceti, Kalluruvikkoti, Kalluruvipoondu, Kallurvi, Malaimurikacceti, Malaimurikam, Nirneruppu, Pakuputtipati, Pasanapetam, Pasanapeti, Tavakkini, Tipputu,

Neermulli; **India** (Telugu): Agnivēndrapāku, Agnivēndramu, Agnijwāla, Bhar jambol; **India** (Urdu): Agya; **International** (Arabic): Hānnṭā barīyah, ʻAḥmar as-sāq al-malakī; **International** (Chinese): Shuǐ sī tóng, Shuǐ xiàn cài, Xī yè shuǐ xiān, Jiāng guǒ shuǐ xiān, Shui xian cai; **International** (Dutch): Brandende Ammannia; **International** (English): Monarch redstem, Blistering ammannia, ammannia, acrid weed, toothcup, Eared Redstem, Redstem Toothcup, Redstem ammannia, Bloodflower; **International** (French): Ammannia brûlante; **International** (German): Brennende Ammannia; **International** (Italian): Ammannia vescicolosa; **International** (Portuguese): Ammannia vesiculosa; **International** (Russian): Puzyrchatka pylayushchaya, Ammaniya yagodonosnaya, Ammaniya yagodnaya; **International** (Spanish): Ammannia abrasadora; **Iraq** (Arabic): Rigl Hemamah; **Israel** (Hebrew): Amanyá mitzríyt, Omnīh mitzrīt; **Japan** (Japanese): Híbiku amania, Nagató-miso-hagi, Shíma-miso-hagi; **Myanmar** (Burmese): K'nyoet pain; **Nepal** (Nepali): Ambār; **Nigeria** (Hausa): Tamfa; **Philippines** (Tagalog): Bias-pugo, Apoy-apoyan, Parapit-angit; **Senegal** (Wolof): Vakeń; **South Korea** (Korean): Bultaneun ammania; **Thailand** (Thai): Kæo raknāa, Mafai nok khum, Yaa raknāa; **Vietnam** (Vietnamese): Mui cho.

Conservation value:

Least Concern - LC (IUCN, 2025)

Distribution:

The native range of this species comprises Africa, tropical and subtropical Asia, and Australia. It has been introduced to Japan, Greece, Jamaica, and Puerto Rico (POWO, 2025).

Habitat:

Ammannia baccifera is a wetland annual herb inhabiting shallow freshwater environments such as marshes, flooded rice paddies, irrigation ditches, stream and pond margins, and seasonally inundated depressions. It thrives in muddy, nutrient-rich, waterlogged soils and is especially common in tropical and subtropical lowland regions. The species occurs from sea level up to approximately 1,200 m elevation. It frequently appears as a weed in flooded or irrigated rice systems during the wet season, growing either submerged or emergent, depending on water depth. It is also found in disturbed aquatic or semi-aquatic habitats such as roadside ditches and ephemeral pools (Florabase, 1998; IUCN, 2010; PROSEA, 2016; India Biodiversity Portal, 2025a).

Invasiveness: -

Ethnobotany:

Cultural and traditional uses: *Ammannia baccifera* is a species that is sometimes included in the diet of local communities, especially in times of food scarcity. The plant, which grows in rice fields, is sometimes used as a leaf vegetable by the Bariba and Wama ethnic groups in Benin. However, its consumption is limited to rural areas (Achigan-Dako et al., 2010). A similar pattern can be observed among the Indian Meitei community in Manipur, where *A. baccifera*, locally known as Ishing kundo, is considered a wild edible plant. It is used as an additional source of food, especially during floods, famines and epidemics (Singh and Binu, 2016).

In many regions, *A. baccifera* is valued for its vesicant properties, which make the plant an important

ingredient in traditional dermatological therapies. In West Africa, Nigerian healers pound the highly acidic leaves into a paste with blistering agent properties, which is then applied directly to the skin to treat chronic dermatological conditions (Burkill, 1985). Further east, traditional medicine in Benin uses the plant to treat fever, malaria, jaundice, and blood clotting disorders. There, too, the plant is commonly used in the form of crushed leaves, which form the basis of many herbal remedies (Achigan-Dako et al., 2010). In Iraq, the plant is also used to treat skin diseases. It is valued above all for its astringent properties, which stimulate blood circulation in the affected areas. However, its internal use is generally avoided due to its very astringent and irritating nature (Al-Douri and Al-Essa, 2010).

The healing potential of *A. baccifera* is best documented in South Asia, where it has been an important element of Ayurvedic and Yunani medicine for centuries. Ayurvedic practitioners believe that *A. baccifera* leaves stimulate the appetite, regulate stomach function and have a laxative effect. They are also considered to be an aphrodisiac. They are mainly used when the body has an excess of two energies – Kapha (manifested, for example, by fluid retention and a feeling of heaviness) and Vata (responsible for digestive disorders and general nervousness). The plant is also said to help with blood problems and painful urination. Ayurvedic practitioners, however, point out that the plant should be used with caution, as long-term use can intensify another condition - Pitta (fire energy), leading to an overproduction of bile, heartburn or inflammation (Kirtikar and Basu, 1918; Government of Bombay, 1953). In Persian-Arabic Yunani medicine, its juice is considered to have appetite-enhancing properties. It is also noted that the plant can cause ulcers and bleeding when used improperly (Kirtikar and Basu, 1918). Indian healers apply chopped fresh leaves of *A. baccifera* externally to induce skin blisters, which are believed to relieve rheumatic pain and fever (Watt, 1893). Another important product used in traditional Indian medicine is the root sap, which is used to treat rheumatic complaints and abscesses. Despite its effectiveness as a vesicant, it has been shown that the properties of *A. baccifera* in causing blisters are inferior to *Plumbago rosea*, and long-term use (12-24 hours) causes significant pain (Dymock, 1885). Besides India, the plant is traditionally used in Nepalese medicine, where it is widely recognised as a medicinal weed in rice fields and is used to treat ringworm, ulcers and even typhoid (Dani and Tiwari, 2018).

In addition to its nutritional and medicinal role, *A. baccifera* has found applications in agricultural and veterinary practices. In the Indian Konkan, the plant was mixed with water and given to livestock to reduce their sex drive, which is said to be a practice rooted in indigenous veterinary medicine (Dymock, 1885). In addition, Nepalese farmers recognise its growth in rice fields as a marker of soil moisture, using its presence as an indicator of wetland conditions (Dani and Tiwari, 2018).

Scientific perspective: Scientific studies confirm the antimicrobial potential of *A. baccifera*. This is particularly true for the treatment of bacterial infections and skin diseases. Its ability to act against various pathogenic microorganisms has been confirmed, thereby supporting its traditional use in dermatological conditions (Prachi et al., 2009). The vesicant properties of the plant can be beneficial when used externally to treat skin problems. However, caution should be exercised, as internal consumption of the plant can lead to severe irritation (Al-Douri and Al-Essa, 2010).

Furthermore, scientific studies have shown that *A. baccifera* has significant antioxidant, anti-inflammatory, and analgesic properties. In a study conducted in Rajasthan, India, the methanolic extract of the aerial parts showed significant showed significant in vitro free-radical-scavenging activity, surpassing the effectiveness of well-known antioxidants such as BHA (butylated hydroxyanisole) and rutin (Loganayaki et al., 2012). The plant's anti-inflammatory potential was in an in vivo carrageenan-induced paw oedema model in rats, demonstrating its ability to reduce oedema and inflammation. Furthermore, *A.*

baccifera has shown strong analgesic effects, which are comparable to standard drugs such as aspirin and morphine. In addition, the plant's characteristic phytochemical composition, in particular its phenolic compounds, flavonoids, and tannins, further support its antioxidant and anti-inflammatory effects.

Ammannia coccinea Rottb.

Family:
Lythraceae J.St.-Hil.

Synonyms: -

Vernacular names:
Argentina (Spanish): Palo de agua, amania escarlata; **China** (Chinese, traditional): Chang Ye Shui Xian Cai; **Colombia** (Spanish): Palo de agua, amania; **Guam** (Chamorro): tetema, astetema; **International** (English): Long-leaf ammannia, Loosestrife, Purple ammannia, Red stem, Tooth-cup, Valley redstem; **International** (French): ammannie écarlate, Ammannia écarlate; **International** (Italian): Ammannia arrossata; **Japan** (Japanese): Hosobahimemisohagi; **Korea** (Korean): Miguk Jombuchot Ggot; **Taiwan** (Tainan, Matao): Chang Ye Shui Xian Cao, Chang Ye Shui Xian Cai; **United States** (Mohave and Yuma tribes): kumu tèrr;

Conservation value: -

Distribution:

The native range of this species extends from North America south to Ecuador, from the Transcaucasus east to Iran and in northern Australia. It is native across large parts of the United States, Mexico, Central America, the Caribbean, northern South America, and parts of western Asia and northern Australia. The species has been introduced into several regions, including southern Europe, parts of South America, East Asia, and Pacific islands (POWO, 2025).

Habitat:

Ammannia coccinea is an annual wetland species typically occurring in freshwater marshes, pond and lake margins, drying mud and sand flats, ditches, railroad swales, and flooded rice fields. It favours muddy or silty substrates and often colonises exposed mudflats. Flowering occurs in full sun from late spring to early autumn. Elevation range extends from approximately 10 m to 1,500 m above sea level (Graham, 2022; FloraVeg.EU, 2022-2025; Flora of the south-eastern United States, 2024).

Invasiveness: -.

Ethnobotany:

Cultural and Traditional Uses: The Mohave and Quechan tribes in North America traditionally used the seeds of *Ammannia coccinea* as a source of food (Castetter and Bell, 1950; Warren et al., 1981). It is likely that, as with other species of the genus, the seeds, which are rich in protein, fat, and linoleic acid, were consumed after roasting (Les, 2018).

Scientific perspective: Phytochemical studies of *Ammannia coccinea* have shown the presence of flavonoids characteristic of the Lythraceae family (Graham et al., 1980; Graham, 1985). Among them, the presence of quercetin 3-O-β-D-glucoside, rutin, luteolin 7-O-β-D-glucoside, isorhamnetin 3-O-rutinoside, apigenin 7-O-β-D-glucoside, vitexin, and kaempferol 3-O-rhamnoglucoside was noted (Les, 2018).

The selective ovicidal potential of this species has also been demonstrated. Aqueous extracts from the plant demonstrated toxicity when injected into American cockroaches. However, they had no effect on German cockroaches or milkweed bugs. Kerosene extracts, by contrast, were toxic to black carpet beetle larvae, but ineffective against German cockroaches, milkweed bugs, larvae of webbing clothes moths, *Aedes* mosquitoes, and *Anopheles* mosquitoes. Alcoholic extracts, on the other hand, were non-toxic to all insect species tested (Heal et al., 1950).

Ammannia prieuriana Guill. and Perr.

Family:

Lythraceae J.St.-Hil.

Synonyms:

Ammannia archboldiana A.Fern., *Ammannia pusilla* Sond., *Ammannia senegalensis* f. *patens* Hiern

Vernacular names:

Israel (Hebrew): אמניה רבת-תפרחים, amanyah rabbat-perachim.

Conservation value:

Least Concern – LC (IUCN 2025)

Distribution:
The native range of this species extends from tropical and Southern Africa to the eastern Mediterranean region. It is native across much of sub-Saharan Africa, including West, Central, East, and Southern Africa, as well as parts of the Sahel and the Levant (e.g., Israel and Palestine) (POWO, 2025).

Habitat:
Ammannia prieuriana is a hydrophytic herb typically associated with moist and aquatic environments. It thrives along the margins of rivers, ditches, and other bodies of water, and is commonly found in standing water, often shallow but occasionally reaching depths of up to 60 cm in riverbeds. This species also colonises temporary pools in rocky or damp sandy substrates, as well as areas with black soil and wet grasslands. Notably, it occurs frequently in rice fields, benefiting from the seasonally flooded conditions characteristic of paddy cultivation. Its altitudinal range spans from 30 to 2,250 metres above sea level, indicating a high degree of ecological adaptability across both lowland and montane regions (Ghogue, 2020a).

Invasiveness: -

Ethnobotany:
Currently, there is almost no information available on the traditional uses of *Ammannia prieuriana*. The only information recorded so far comes from a 1976 paper by John Kokwaro on medicinal plants used in East Africa. According to this, the plant is used in the form of an infusion made from its fresh leaves, which is drunk as an anthelmintic (Kokwaro, 1976). To date, no detailed studies have been documented on the phytochemical composition of the plant. Efficacy and safety have not been established; self-medication is not advised.

Apluda mutica L.

Family:
Poaceae Barnhart

Synonyms:
Apluda varia Hack., *Calamina mutica* (L.) P.Beauv., *Tripsacum giganteum* (P. Beauv.) Raspail, *Xerochloa latifolia* Hassk.

Vernacular names:
Afghanistan (Dari): قرش (Sharq); **Bhutan** (Dzongkha): Karuki; **Hong Kong** (Mandarin): Shuǐ zhè cǎo; **India** (Hindi): Akku hullu, Baanb, Babar, Bhajura, Bhangri, Bhanjra, Bhanjura, Bhanjuri, Bhankta, Bhas, Bhickma, Bhongla, Bhongta, Bhumbhuru, Bhus jari, Bonta, Chhari, Chickwar, Chotki basar, Dhanghi khad, Dhuri ghas, Gandhani, Gandhi, Ganni, Gawan, Ghaghara, Ghandani, Goroma, Gugar gadi, Kaadu hanchi hullu, Kadmor, Kari hanchi hullu, Kari kaachi, Kari kaachi hullu, Karmoria, Kattingiya sufed, Kharvel, Khavas, Kurdia, Makkha, Manda pillu, Manda pul, Moongil pul, Moshi, Mungil pillu, Munmona, Murmuru, Palakhari, Paodi, Patpatawan, Phota, Phula jara, Phulaer, Phules, Phuli, Phulor, Phulria, Phulse, Poklia, Poladi gavat, Poleda, Polki, Ponai, Pongta, Pootstrangali, Putstryagali, Sanna kari hullu, Santhran, Send, Tach, Tachhila, Tachila, Tachla, Tachula, Tambat, Tambati, Tulse paodi, Chadi, Chari, Holera, Phulia, Tacla; **India** (Maharashtra): Phuti; **India** (Rajasthan): Tamta bheda; **Indonesia** (Indonesian): Kerpah, Kerpak, Kerpak awu, Klitik, Merakan, Suket klitik, Wuluhan; **International** (Chinese): Jiǎ què mài, Shuǐ yàn cǎo, Shuǐ zhè cǎo; **International** (English): Common apluda, Glutinous rice grass, Gluten-rice grass, Snubgrass, Water oats grass; **International** (Russian): Apliuda tupaia, Myakinnik bezostyy, Myakinnik tupokonechnyi; **Japan** (Japanese): Ineka hime karukaya, Okinawa karukaya; **Macau** (Mandarin): Shuǐ zhè cǎo; **Myanmar** (Mranma bhasa): Myet-swe-le, Myet-wa; **Nepal** (Chepang): Phokro no; **Nepal** (Nepali): Dakle Khar, Daike Jhar, Sali Banso; **Pakistan** (Khyber Pakhtunkhwa, Pashto): راوخ (Khawar); **Pakistan** (Pashto): Pashkalay Wakha; **Sri Lanka** (Sinhala): Kuru kudu tana, Kuru kuda tana, Moongil pul, Mungil pul, Munjil pul; **Taiwan** (Mandarin):

Shuǐ zhè cǎo; **Thailand** (Thai): Ya kom bang, Ya phai, Ya phrik phran; **Vietnam** (Vietnamese): Cỏ lá tre.

Conservation value: –

Distribution:

This species is native to South and South-East Asia, extending from the Indian subcontinent through southern China, Indochina, and Malesia (a biogeographical region covering Malaysia, Indonesia, the Philippines, New Guinea, and surrounding areas) to the western Pacific, including numerous island groups in the Indian and Pacific Oceans. It has been introduced to Maryland, the USA. Its presence in Iraq is considered doubtful (POWO, 2025).

Habitat:

Apluda mutica is a perennial grass native to tropical and subtropical Asia. It typically grows in open grasslands, forest margins, roadsides, moist deciduous forests, and waste places (Flowers of India, 2005; Flora of China Editorial Committee, 2006; India Biodiversity Portal, 2025b). The species prefers well-drained sandy to loamy soils and is adapted to seasonally dry tropical climates. Although *Apluda mutica* is not commonly found in permanently flooded paddy fields, it has been documented as a weed in upland and rain-fed rice cultivation systems, particularly in shifting cultivation areas. Specimens collected in the Philippines confirm its occurrence as a weed in rice fields and along rice terraces, indicating its capacity to colonise disturbed agricultural habitats in tropical Asia (Smithsonian Institution 1950, 1953).

Invasiveness: -

Ethnobotany:

Cultural and traditional uses: *Apluda mutica* is considered an important forage grass in many regions of Asia. For example, in the Kanyakumari district of Tamil Nadu, the local farmers and shepherds collect this grass from irrigation canals, rice fields, and pastures during the monsoon season and store it for later use as nutritious fodder (Sukumaran and Jeeva, 2011). *Apluda mutica* is also known as an important forage plant in Pakistan. It is considered the most preferred grass species for grazing cattle, sheep, and goats in the hills of the Malakand Pass in the Malakand district. In this region, it is also collected and stored for later use during the dry and winter seasons (Barkatullah and Ibrar, 2011). The same applies to central Punjab, where the plant is used both as fresh fodder and hay (Ilyas, 2015).

The high importance of this grass species for local pastoralism is also reflected in traditional practices to ensure the sustainable use and management of the areas where it occurs. In the Garhwal Himalayas, for example, farmers maintain naturally regenerating forage grasses, including

Apluda mutica, along terraced fields. This simultaneously fulfils the need for fodder for livestock and the continuous protection of the characteristic communities of these areas (Nautiyal et al., 2018). The Gujjar people living in Malakand also practise sustainable pasture management traditionally to maintain the natural pastures containing *Apluda mutica*. This includes mowing and drying the grass before the rainy season, which prevents feed shortages in remote mountain areas (Barkatullah and Ibrar, 2011).

Apluda mutica is reportedly used in traditional medicine in many Asian communities. In China, the plant is traditionally used to heal snakebite wounds, treat ulcers, and prevent fungal infections. It is used to remove necrotic tissue and aid in managing infections (Wiart, 2006; Ye et al., 2017). In addition, a paste made from the shoots of *Apluda mutica* is applied to snakebite wounds to neutralise the venom and promote wound healing (Guangdong Institute of Botany, 1985). In West Bengal, a decoction of the plant is traditionally used as a diuretic to treat dysentery and ascariasis. It is also common to chew the leaves on an empty stomach to help regulate blood sugar levels (Datta et al., 2022). In addition, leaf paste is used topically to stop bleeding, as in Chinese medicine. Furthermore, this paste is used throughout India to treat mouth ulcers (Shruthi and Kotresha, 2024).

Apluda mutica also has a wide range of applications in Asian veterinary practice. In India, it is traditionally used to treat mouth ulcers in cattle, as is the case with humans (Katewa et al., 2001). Interestingly, in Rajasthan, it is common practice to give cattle shoots of this plant mixed with small fish to treat flatulence (Katewa et al., 2001). *Apluda mutica* has a similar significance in Pakistan's veterinary practice. Its roots are crushed into a paste, mixed with mustard oil, and given to calves to help treat mouth ulcers (Ilyas, 2015).

In addition to its medicinal and nutritional uses, *Apluda mutica* also has other, more technical applications. In Nepal, especially among the Chepang community, it is used as a building material for thatching houses (Rijal, 2011). It is also used in a similar way in Punjab, where, in addition to roofing, it is used to make baskets and as a cover for crops to protect them from ground frost (Harun et al., 2017).

Scientific perspective: Studies of the nutritional composition of forage plants used in Wardha, Maharashtra, India, have shown that, on a dry-matter basis, *Apluda mutica* contains 4.15% crude protein, 29.89% crude fibre, 1.01% ether extract (oil), 8.96% ash and 5.34% silica (Kauthale et al., 2017). *A. mutica* had the highest ether extract (oil) content of all the analysed forage plant species. This indicates its considerable potential as an energy source for livestock (Kauthale et al., 2017).

The phytochemical analysis showed the presence of phenolic compounds and flavonoids in the plant, which are known for their anti-inflammatory, antioxidant and antidiabetic effects (Datta et al., 2022). These compounds have an indirect effect on neutralising free radicals, reducing inflammation and regulating blood glucose levels (Shruthi and Kotresha, 2024). High-performance liquid chromatography (HPLC) detected chlorogenic acid, syringic acid, ferulic acid and sinapic acid, supporting the plant's traditional use in ethnomedicine (Datta et al., 2022). Liquid chromatography–mass spectrometry (LC–MS) analysis identified ten bioactive compounds, with the main components including 2-O-rhamnosyl-swertisin (45.00%), sennoside C (27.32%), renchangianin B (7.13%), and quercetin 3,7-dimethyl ether (6.16%) (Shruthi and Kotresha, 2024). These compounds have strong antioxidant, antibacterial, anti-inflammatory and antidiabetic properties, which are also reflected in the traditional uses of the plant. Methanol extracts of *Apluda mutica* have shown moderate antibacterial activity, with the highest inhibition observed against *Enterococcus faecalis*, followed by *Staphylococcus aureus* and *Escherichia coli* (Shruthi and Kotresha, 2024).

Arachis pintoi Krapov. and W.C.Greg.

Family:
Fabaceae Lindl.

Synonyms: –

Vernacular names:
Bolivia (Trinitario): Tmouru ‘chi’chu; **Bolivia** (Yuracaré): Sebbe; **Brazil** (Portuguese): Amendoim-forrageiro; **China** (Chinese, simplified): 遍地黄金 (Biàndìhuángjīn), 平托花生 (Píngtuō huāshēng); **Colombia** (Spanish): Maní forrajero; **Costa Rica** (Spanish): Povenir; **Indonesia** (Indonesian): Kacang pinto, Kacang hias, Kacang-kacangan, Rumput Pinto; **International** (English): Pinto peanut, Forage peanut, Yellow peanut plant; **International** (French): Arachide sauvage, Arachide de Pinto; **International** (Russian): Арахис Пинто (Arakhis Pinto); **Mexico** (Spanish): Cacahuate, Manicillo; **Panama** (Spanish): Maní forrajero; **Philippines** (Ayta, Porac Pampanga): Mani-manian; **Philippines** (B’laan, Mindanao): Mani-mani; **Philippines** (Tagalog): Mani-manian, Mani-mani; **Taiwan** (Chinese, traditional): 蔓花生 (Màn huāshēng); **Thailand** (Thai): ถั่วลิสงเถา (Thua lisong thao); **Vietnam** (Vietnamese): Cỏ đậu, Cỏ lạc.

Conservation value: –

Distribution:
The native range of *Arachis pintoi* is in central and eastern Brazil, particularly in the Northeast, Southeast, and Central-West regions. It has been introduced to other parts of South and Central America, as well as to Hawaii, Queensland (Australia), and Sri Lanka (POWO, 2025).

Habitat:
Arachis pintoi is a stoloniferous perennial legume that inhabits open grasslands, forest edges, and various disturbed sites, such as degraded pastures and plantation understories. The species thrives on well-drained sandy to loamy soils, typically found in humid tropical and subtropical climates with moderate to high rainfall. It grows in full sun to partial shade, tolerates acidic, low-fertility soils with high aluminium and manganese levels, and exhibits a broad environmental tolerance. In cultivated settings, it is commonly used for soil stabilisation, ground cover, pasture improvement, and erosion control. Moreover, it has been documented at elevations from sea level to approximately 1,400 m a.s.l., which demonstrates its adaptability to upland tropical zones (Heuzé et al., 2017; Tropical Forages, 2020).

Invasiveness: –

Ethnobotany:

Cultural and traditional uses: *Arachis pintoi*, unlike its relatives, does not produce edible groundnuts, but has a wide range of uses. This applies to both its medicinal properties and its importance in traditional agriculture. In folk medicine, this plant is valued in Kalinga Province, Philippines for the treatment of varicose veins and convulsions. The whole plant, after being mashed, is applied by traditional healers topically to the affected areas (Manuel et al., 2021). The traditional use of the plant in medicine also extends to South America. In Bolivia, the indigenous Yuracaré and Trinitario people grow the plant in their home gardens. An infusion prepared from the plant is used to treat sore throats and stomach aches and, according to local recommendations, must be consumed three times a day (Thomas and Vandebroek, 2006). *Arachis pintoi* is also important in maternal healthcare. For example, in the Ayta community of Porac, Pampanga in the Philippines, the plant is used to treat 'binat', a condition known as postpartum weakness (Ragragio et al., 2013). The B'laan tribe in Mindanao uses the plant to treat beriberi in pregnant women, a nervous system disease resulting from vitamin B1 deficiency (Alinsug et al., 2022).

In agriculture, *Arachis pintoi* is considered a valuable forage plant in Brazil. This is mainly due to its high protein content. It is also often sown in pastures and intercropped to increase soil fertility due to its high nitrogen-fixing capacity (Ministério do Meio Ambiente, 2016). The plant is also used as a ground cover in orchards and oil palm plantations. In this case, this is due to its high shade tolerance and thus its ability to prevent weed growth and conserve soil moisture. Besides these uses, *Arachis pintoi* is also sometimes sown in Brazilian home gardens as an ornamental plant (Valls and Coradin, 2016). In Costa Rica and Colombia, the plant is known for its ability to increase milk production and liveweight gain in cattle when included in feed (Hernández et al., 1995). In Mexico, *Arachis pintoi* is also mainly used as a fodder legume. It is cultivated there either in combination with grasses or as a monoculture (Alatorre Hernández, 2016). It is also used as feed for livestock in rural communities in Ecuador, especially in combination with *Axonopus scoparius* (Heras-Heras et al., 2023).

In Asia, *Arachis pintoi* is also known as a valuable livestock feed. It also plays an important role in land restoration programmes (Maswar, 2004). In Vietnam, *Arachis pintoi* is widely used in agroforestry systems, where it is sown as a ground cover under coffee plantations (Kerridge and Hardy, 1994). In Nepal, it is increasingly used for stabilising soils on riverbanks and hillsides due to its extensive root system (Valls and Coradin, 2016).

Arachis pintoi also has symbolic significance in some regions. This is particularly true of Afro-Cuban religious systems. In Santería and Palo Mayombe rituals, it is venerated for its symbolic and practical significance. It is believed to have spiritual power, which is linked to ancestor worship and protective rituals. Therefore, it is used in local rites for sacrificial purposes (Delgado Súmar, 2018-2019).

Scientific perspective: It has been shown that the high crude protein content of *Arachis pintoi* (13-25%), combined with a digestibility rate of 60-75%, significantly increases the productivity of livestock and thus supports sustainable grazing systems (Sotomayor-Ríos and Pitman, 2001). In addition, *Arachis pintoi* shows persistence under grazing and mowing, mainly due to its creeping habit. This allows the plant to maintain productivity and resilience even under intensive grazing. Therefore, it is possible to ensure the availability of fodder year-round. It has also been shown that when cultivated together with grasses of the genus *Brachiaria*, *Arachis pintoi* also improves soil fertility. By increasing the nitrogen content in the soil, this species has a positive effect on the growth of the accompanying grasses. In addition, its creeping growth pattern allows it to coexist harmoniously with grasses such as *Brachiaria humidicola*, forming a dense soil cover that reduces soil erosion and

improves water infiltration. This system is particularly effective in tropical pastures, which require special attention to maintain soil fertility and sustainability (Villarreal et al., 2005).

The Brazilian variety *Arachis pintoi* 'Belmonte' has been thoroughly studied for its chemical composition and phenolic content at different stages of plant growth. The study showed that the total tannin content was 20.2 g/kg dry matter (DM), the phenol content was 31.8 g/kg DM and the condensed tannin content was 15.7 g/kg DM. The tannin levels in the plant have been shown to increase protein utilisation by forming protein-tannin complexes that reduce protein degradation in the rumen. This, in turn, increases the amount of rumen-undegradable protein (RUP) available for absorption in the intestines. Furthermore, tannins have been shown to reduce the number of gastrointestinal parasites. Too high a tannin concentration (>45 g/kg DM) can impair digestibility and reduce feed intake. *Arachis pintoi 'Belmonte'*, however, maintains a moderate tannin level while providing antiparasitic benefits (Paulino et al., 2012).

Argemone mexicana L.

Family:
Papaveraceae Juss.

Synonyms:
Argemone mexicana var. typica Prain, *Echtrus mexicanus* (L.) Nieuwl., *Papaver mexicanum* (L.) E.H.L.Krause, *Argemone leiocarpa* Greene, *Argemone spinosa* Gaterau

Vernacular names:
Angola (Portuguese): papoula, papoula-do-México; **Argentina** (Spanish): amapola montés, cardo amarillo; **Austria** (German): Mexikanischer Stachelmohn; **Bahamas** (English): donkey thistle; **Bangladesh** (Bengali): শয়িালকাঁটা (shialkanta), বড় শলি-কাঁটাল (bara shil-kantal); **Bangladesh** (Santhal - Naogaon District): Sialkanta; **Benin** (Fon): Houètchégnon; **Benin** (Fon - Plateau of Allada): Houètchégnon, Ahouaniklangohoun, Ahondja; **Benin** (French): débilo, timtonyakorou; **Bolivia** (Spanish): carhuincho; **Botswana** (Tswana): lepero; **Brazil** (Portuguese): cardo-amarelo, cardo-santa-maria, cardo-santo, erva-de-cardo-amarelo, falso-cardo, figo-do-inferno, papoula-de-espinho, papoula-do-México, papoula-espinhosa, papoila-de-espinho, papoila-de-México; **Burkina Faso** (French): bara, baragoué, blatoumé, mérékagnien, souroukou taba, yra; **Chile** (Spanish): cardo blanco, chicalote; **Côte d'Ivoire** (French): baragoué, blatoumé, mandé, mérékagnien, souroukou taba, wenigbé; **Cuba** (Spanish): cardo santo; **Czech Republic** (Czech): pleskanka mexická; **Djibouti** (Afar): Bangi; **Dominican Republic** (Spanish): cardo santo; **Eritrea** (Tigrigna): ዳንደር (dander); **Estonia** (Estonian):

mehhiko ogamagun; **Ethiopia** (Afar - Aba'ala region): Hedehara; **Ethiopia** (Amharic): ባሮ ባንጊ (baro bangi), እሾክ ትሊያን (eshok tilian), ኮሬሃሬ (korehare), ኮሳላ (kossalae), ማዳፌ (madafe); **Ethiopia** (Tigrigna): መዳፈ ትሊያን (Medafe tilian); **Finland** (Finnish): keltapiikkiunikko; **Finland** (Swedish): gul taggvallmo; **Ghana** (Akan): Akusiribie; **Ghana** (Twi): Kokosakyi aduro; **Haiti** (French/Creole): cardon fleurs jaunes, chadron à fleurs jaunes, chardon béni, pavot épineux; **Hindustan** (Unknown language): Suchianas; **Honduras** (Spanish): adormidera espinosa, chicalote; **Hungary** (Hungarian): mexikói tüskés mák; **India** (Andhra Pradesh - East Godavari District, Addatheegala region - Telugu): Balurakkasi; **India** (Andhra Pradesh - Srikakulam District - Telugu): Balurakkasi; **India** (Bengali): গ্লমকুল (glmkul); **India** (Hindi and Bengali): Sial kanta; **India** (Hindi/Sanskrit): satyanashi, suvarnakshiri, svarnadugdha, kataila, भरभाँड (bharbhand), सियालकांटा (siyalkanta), Pili kateri, Gokhula janum; **India** (Hindi/Urdu – regional): Peela; **India** (Santhali, Bhumij, Munda, Oraon, Birhor, Mal Pahariya, Kharia, Ho): Bukla kanta, Sialkanta, Bakula janum, Rangaini; **India** (Santali): Ujar hata, Atkuti-janum; **India** (Tamil): பிரம்மடண்டி (brahmadandi), பிரம்மடந்தி (brahmadanti), பிரஹ்மி டண்டி (brhami dandi), கண்ணாடி டட்டூரி (kannadidatturi), விரிஞ்சனஞ்சடெி (virincananceti), பிரமதாண்டு (piramathandu), Bramadandoo; **India** (Uttar Pradesh): Bharbhanda; **India** (Unknown): Seyāl kanta; **Indonesia** (Indonesian/Javanese): druju, celangkringan, droedjoe, tjelangkringan; **International** (Danish): pigvalmue, Mexicansk pigvalmue; **International** (Dutch): stekelpapaver; **International** (English): Mexican poppy, Mexican prickly poppy, goatweed, prickly poppy, Feringie Datura; **International** (French): argémone, argémone du Mexique, argémone mexicaine, chardon, chardon béni, chardon du pays, herbe à femme, pavot épineux, chardon béni des Antilles, pavot du Mexique, tache de l'œil; **International** (German): gemeiner Stachelmohn, mexikanischer Stachelmohn, Teufelsfeige; **International** (Italian): papavero messicano, papavero mexicano, papavero spinoso, papavero spinosa, fico infernale, papavero del Messico, figo del inferno; **International** (Latin): ficus infernalis; **International** (Mandarin): 蓟罂粟 (ji ying su), **薊罌粟** (ji ying su); **International** (Spanish): cardo, cardo santo; **Israel** (Hebrew): ינקיסקמ וומגרא (argemon meksikani); **Jamaica** (English): Holy thistle, blessed thistle, Mexican poppy, yellow thistle; **Japan** (Japanese): アザミゲシ (azami-geshi), あざみげし (azamigeshi); **Kenya** (Swahili): ekijembajembe, mkumajalaga; **Libya** (Arabic): تسمماج (tasmamaj); **Madagascar** (Malagasy): fantsimboay, botakoa; **Malaysia** (Malay): chelang keringan; **Mali** (Bambara): Bozobo; **Mali** (Dogon): Aignètawa, Sonkeriai; **Mali** (French): bozobo, gninnidie, simsimji; **Mali** (Senoufo): Naka - taba; **Mauritius** (French/Creole): chardon du pays; **Mexico** (Spanish): adormidera espinosa, amapolas del campo, chicalote, chicallotl, amapolo pinchuda, cardo amarillo, cardo blanco, cardo santo, amapolilla; **Myanmar** (Burmese): kye-ja; **Nepal** (Nepali): बर्बन्दा (barbanda), कटारा (katara), पलन्ती कांटा (palanti kanta), सुंगुरे कांदा (sungure kanda), सुंगुरे कांटो (sungure kanto); **Niger** (French/Hausa): Boginahi, Dàyí gííwáá, Hákóórín kádà, Káákí rúwàn Allàh, Kàankámárkà tà bíí kà, kamukamu, Kánkàámáá, Karanko, Kùùrár fataakee, Kwarakko, Kwaranko, Wagiri, Wasiri; **Nigeria** (Hausa): Boginahi; **Nigeria** (Hausa/Yoruba/Igbo): akunakun, Boginahi, Dàyí gííwáá, Hákóórín kádà, Káákí rúwàn Allàh, kamukamu, mafowokanmomi; **Norway** (Norwegian): piggvalmue; **Pakistan** (Punjabi - Gujranwala region): Stianasi; **Pakistan** (Urdu/Punjabi/Sindhi): کنڈیری (kanderi), کنڈیاری (kundiari), سیالکانٹھ (sialkanta); **Paraguay** (Spanish): cardo santo; **Philippines** (Tagalog): diluariu, kachumba, kasubang-aso; **Poland** (Polish): argemon meksykański; **Réunion** (French): chardon; **Saudi Arabia** (Arabic): انيمرجرأ (argemnia); **Senegal** (Diola): Fambora; **Senegal** (Mandinka/Manding): bozobo, tilinafelêjˀ, simsimjˀi; **Senegal** (Serer): ga-pey korkot, gapéye korkot; **Senegal** (Wolof): Garabu-mag; **Senegal** (Unknown language): tôbôn sama, diahanabalâtoo, bidior; **Slovakia** (Slovak): Mexický mak; **South Africa** (Afrikaans): Steekbossie; **South Africa** (English): yellow-flowered Mexican poppy; **South Africa** (Sotho): ntsvantsane, nthswantsane, sehlôhlô-se-seholo; **South Africa** (Zulu/Xhosa/Afrikaans): ikhakhakhakha; **Sri Lanka** (Sinhalese): රන්කිරි ගොකටු (rankiri gokatu); **Sudan** (Local): Ngolokogodie; **Sweden** (Swedish): gul taggvallmo; **Tanzania** (Bunda district - Kurya): Rikararungu; **Tanzania** (Bunda district - Sukuma): Rangiibili; **Tanzania** (Swahili): akatojo, rangiibili, rikararungu; **Togo** (Adja): Houétchègnon; **Vietnam** (Vietnamese): cà gai hoa vàng, gai cua, mủi cua; **Zimbabwe** (Shona/Ndebele): umjelemani.

Conservation value: –

Distribution:

The native range of this species extends from central Mexico to Honduras. It is now widely naturalised throughout most warm regions of the world, where it often occurs as a weed (POWO, 2025).

Habitat:

Argemone mexicana widespread weed of open, disturbed tropical habitats. It occurs along roadsides, railways, waste ground, fields, and stony ridges, and also on cultivated land, pastures, and fence lines (Fern et al., 2025; WFO, 2025). The species is adapted to a wide range of ecological conditions, from sub-humid to semi-arid environments, and occurs on various soil types, including sandy and stony soils. In Mauritius, it is most abundant in sub-humid regions; in Puerto Rico, it prevails in semiarid northern areas. Though often found at sea level, it can occur up to 2,900 m in Tanzania. In Australia and southern Africa, it grows along riverbeds, while in Hawai'i it is naturalised in dry, disturbed areas (Wagner et al., 1999). In Fiji, it is occasionally naturalised on sandy soils and in coastal cane fields (Smith, 1981).

Invasiveness:

Although *Argemone mexicana* is not currently listed in the Global Invasive Species Database (GISD) and has not been classified as an invasive species at the global level, it is nonetheless considered invasive in several regions. For instance, in South Africa, it is categorized as a Category 1b invasive plant, indicating that it must be controlled and may not be cultivated or traded (Invasive Species South Africa, 2025).

Ethnobotany:

Cultural and traditional uses: *Argemone mexicana* was introduced to Europe in 1593 by Joachim Camerarius the Younger from Nuremberg under the name 'Figo del inferno' (Bauhin, 1671). The Spanish adopted this name because of the strong narcotic effect of the seeds, which at that time were considered stronger than opium (Lindley, 1838). According to available records, *Argemone mexicana* has been used in traditional medicine for centuries. Ancient Indian texts describe its use in the treatment of cataracts and chronic skin diseases. In colonial times in Latin America, this species was widely used as a remedy for respiratory ailments. European travellers documented its use in indigenous healing practices in Mexico as early as the 18th century (Neag et al., 2018). Today, in the area around the Gulf of Mexico, where *Argemone mexicana* originates, it is still traditionally used to treat respiratory diseases, fever and gastrointestinal problems. In Mexico, its latex is applied topically to skin infections and warts. Meanwhile, the seeds and aerial parts are used as an analgesic and antispasmodic (Neag et al., 2018). Despite its widespread use in traditional Mexican medicine, *Argemone mexicana* is considered toxic there. Therefore, the use of this species is accompanied by precise recipes. For example, traditional infusions are made using 1-3 g of leaves in 1 litre of water and consumed three times a day. Exceeding this dosage can lead to serious side effects. According to local reports, these can include dermatitis, miscarriages and even paralysis or death (Alonso-Castro et al., 2017).

Traditional medicine in the neighbouring Caribbean also draws on the healing properties of *Argemone mexicana*. Among the rural population in the Dominican Republic, a root decoction is taken orally to relieve stomach pain. Here, too, traditional practitioners strongly advise against the use of it by children, pregnant women and breastfeeding mothers (Germosén-Robineau, 2014). In the Bahamas, *Argemone mexicana* is mainly used to treat hepatitis. For this purpose, the whole plant (including the roots) is simmered until a thick consistency is reached. The preparation is then consumed. It is also used to make an infusion that is drunk as tea. It is said to have a detoxifying effect on the body and to regulate fluid balance and urination. The plant is also used externally. The sap from the stem is used as a lotion for the skin and to treat warts and

fungal infections (Halberstein and Saunders, 1978). In Jamaica, *Argemone mexicana* is also consumed in the form of a morning tea to improve appetite. It is also used to prepare special baths with boiled parts of the plant to help relieve the symptoms of colds (Vandebroek and Picking, 2020).

In Latin America, *Argemone mexicana* is also widely used in folk medicine. In the Brazilian region of Cariri Paraibano in the state of Paraíba, its latex is commonly used to treat conjunctivitis by instilling a small amount directly into the eyes. In addition, an infusion of the seeds is drunk after meals to promote digestion (Agra et al., 2007). In Bolivia, by contrast, an infusion of the flowers is drunk to treat coughs. However, the seeds are also known as a laxative (Vandebroek and Picking, 2020). In Paraguayan folk medicine, *Argemone mexicana* is known as an abortifacient and contraceptive (Basualdo and Soria, 2014). The medicinal uses of *Argemone mexicana* also extend to Réunion. On this island, its boiled root is used to treat conditions such as bladder pain, urinary retention, leucorrhoea, menopausal disorders, diabetes, and rheumatism. The latex is used for inflamed lips and fever blisters. Baths made from the leaves of the plant are a recognised remedy for haemorrhoids. Its seeds are also valued in Réunion, mainly for their laxative properties (Lavergne and Véra, 1989).

Regardless of its origin, *Argemone mexicana* is also widely used in traditional medicine in West Africa. It is valued for its effectiveness in treating digestive problems, muscle pain, gonorrhoea, jaundice, malaria, coughs, toothaches, eye pain, fever, eczema, and urinary tract problems. The plant's sap is also used as a sedative and antiemetic. Moreover, it is used to treat ear infections and eye diseases. The aerial parts of the plant, including the seeds, are often administered as an infusion to act as a diuretic, laxative, and diaphoretic. Furthermore, its seed oil is used to treat constipation, insomnia, skin infections, and ulcers (WAHO, 2013). In Mali, the plant is a key ingredient in the registered herbal antimalarial medicine 'Sumafoura Tiemoko Bengaly'. The remedy, which was developed using local traditional knowledge, is used to treat malaria (Adodo and Iwu, 2020). In neighbouring Benin, a decoction made from the leaves, flowers, and fruits of *Argemone mexicana* is also consumed to treat malaria, especially among the Fon people on the Allada Plateau (Yetein et al., 2013).

Moving eastwards, the medicinal properties of *Argemone mexicana* are utilised in the Zoba Maekel and Zoba Semenawi Keih Bahri regions of Eritrea. The plant's latex is used as an antibiotic and a remedy for cataracts (Yemane et al., 2018). Meanwhile, in Djibouti, the Afar community in the Randa region uses a paste made from its leaves as a topical treatment for wounds. However, use of the plant is approached with particular caution among this population. The local community believes that excessive use of the plant can cause internal bleeding

and what they refer to as 'mental instability' (Hassan-Abdallah et al., 2013).

The extensive range of medicinal uses of *Argemone mexicana* can be found in South Asia, especially in India. As in the previous cases, in the state of Maharashtra, the plant is used to treat malaria, skin diseases, fever, jaundice, and eye infections. In this region, however, it is sometimes combined with other medicinal plants. For example, to treat malaria, a paste of the root of this plant wrapped in a betel leaf is consumed three times a day. For skin diseases, root powder mixed with sugar is taken (Beldar and Sidat, 2020). In the traditional Ayurvedic system, *Argemone mexicana* is considered a plant with the ability to tame vitiated 'pitta', an imbalance in bioenergy governing metabolic processes, thermoregulation and enzymatic activity. It is therefore used to treat a number of ailments, including worm infestation, skin diseases, inflammation, poisoning, constipation, flatulence, colic, and malarial fever (Singh, 2013). Among the tribal communities living in the Ayodhya Hills of West Bengal, *Argemone mexicana* is used to treat skin and eye diseases. A traditional preparation used to treat scabies is made by boiling 2 teaspoons of seed powder with 50 grams of mustard oil (Sur et al., 1987; Dey and De, 2010). The plant is also used in a similar way in Tamil Nadu (Lakshmanan et al., 2018). In addition, members of tribes such as the Santhali, Bhumijs, Mundas, Oraon, Birhor, Mal Pahariya, Kharia, and Ho commonly use the plant's sap to treat sore and red eyes (Dey and De, 2010).

Outside India, *Argemone mexicana* is commonly used among the Santhal community in Bangladesh. In this case, root sap is consumed as a diuretic. The stems, on the other hand, are added to curries as a remedy for diabetes and jaundice. In addition, as in previous cases, the plant's latex is applied to the skin to relieve itching and other dermatological problems (Rahman et al., 2010). In the Peshawar Valley in Khyber Pakhtunkhwa, Pakistan, the plant and its seeds are pulverised and taken to treat diarrhoea (Bahadur et al., 2018). In the Gujranwala region of Punjab, by contrast, *Argemone mexicana* is

considered an effective laxative (Iqbal et al., 2020). The traditional use of *Argemone mexicana* in the Middle East is centred on its antimicrobial and wound-healing properties. The leaves and seeds of the plant are used for this purpose in Yemen and Saudi Arabia, among other places (Hussein and Dhabe, 2018, Ullah et al., 2020).

Argemone mexicana is also used in traditional ethnoveterinary practices in both Africa and Asia. Among the Afar community in the Aba'ala region of Ethiopia, the seeds are ground, mixed with butter, and applied to the swollen necks of oxen for three consecutive days. This preparation is reported to reduce swelling and aid wound healing (Meragiaw, 2016; Meressa, 2018). Another veterinary application has been recorded in Debark District in northern Ethiopia: farmers burn the roots, and the smoke is inhaled by horses suffering from ulcers (Ruelle, 2015). Among the Gujjar community in Uttarakhand, India, the leaves are first rubbed against a stone to remove the spines and then ground into a paste together with *Trachyspermum ammi.* This paste is then fed to livestock to relieve abdominal pain (Gaur et al., 2010).

In some regions, the plant also has a significant ritual value. In Jamaica, it is known as the 'holy thistle' and is an essential part of baths to ward off evil spirits. Its strong scent is said to repel malevolent spirits (Vandebroek and Picking, 2020). *Argemone mexicana* also has a meaning in the traditional beliefs of the people living in Cuba. In particular, this refers to Santería (a syncretic Afro-Cuban religion, also known as Regla de Ocha), where this species is used in purification rituals, as well as beaing an offering to deities (Carlomagno et al., 2015).

In addition, *Argemone mexicana* is sometimes used for other practical purposes. In Pakistan, the dried plant is used as fuel (Bahadur et al., 2020). Meanwhile, in Zambia, the Tonga people extract oil from the plant to blacken wooden furniture for preservation and aesthetic purposes (Reynolds, 1968). There are also reports that Mexican craftsmen used the seed oil to varnish wood before painting it. This was partly because the latex of the plant turns light yellow when dry, resembling gamboge (Macfadyen, 1837). In Nevis, in turn, oil extracted from the seeds was used as a substitute for castor oil (Lindley, 1838).

Scientific perspective: The most important alkaloids in *Argemone mexicana* are berberine, sanguinarine, chelerythrine, protopine, and allocryptopine, all of which play an important role in its pharmacological effects (Germosén-Robineau, 2014; Patocka et al., 2024). The plant also contains other alkaloids, including dehydrocorydalmine, jatrorrhizine, columbamine, and oxyberberine (Singh, 2013). Berberine is particularly important due to its strong antibacterial, anti-inflammatory and anti-diabetic properties (Vardeman et al., 2025). Sanguinarine and chelerythrine also have strong antimicrobial and analgesic properties. However, these compounds are associated with hepatotoxicity and neurotoxicity, which means that the preparations made from this plant must be used and administered with caution (Carlomagno et al., 2015). Another important alkaloid, protopine, is present in trace amounts in the plant (0.03%). It is known for its narcotic effect. Historically, this alkaloid was described as argemonine, but it was later identified as impure protopine (Watt and Breyer-Brandwijk, 1932). The chemical composition of *A. mexicana* varies depending on the type of plant tissue and processing methods. The above-ground parts show a higher concentration of berberine and greater antimicrobial activity (Vardeman et al., 2025). The rich phytochemical profile of *Argemone mexicana* translates into scientifically proven medicinal properties of its preparations. These include antimicrobial, anti-inflammatory, anti-cancer, hepatoprotective, and anti-diabetic properties. The plant has been proven to have antibacterial properties against pathogenic bacteria such as *Staphylococcus aureus*, *Escherichia coli*, *Bacillus subtilis* and *Pseudomonas aeruginosa* (Adodo and Iwu, 2020; Patocka et al., 2024). Further studies support its use as an anti-malarial agent. Preparations made from it show significant activity against chloroquine-resistant *Plasmodium*

falciparum. Berberine, allocryptopine, and protopine show in vitro anti-malarial activity with IC50 values ranging from 0.32 to 1.46 µg/ml. Furthermore, laboratory studies indicate that methanol extracts from *A. mexicana* exhibit antiplasmodial activity comparable to *Artemisia annua*, which also translates into its effectiveness in treating this disease (Adodo and Iwu, 2020).

The anti-inflammatory and analgesic effects of *A. mexicana* are mainly attributed to sanguinarine and chelerythrine (Carlomagno et al., 2015). Mechanistically, sanguinarine and chelerythrine have been reported to inhibit protein kinase C and NF-κB signalling, which may underlie these effects. The studies conducted so far also confirm its hepatoprotective properties. Berberine also contributes to the plant's anti-diabetic effect by activating AMPK and modulating the gut microbiota, thereby helping to regulate glucose metabolism, and has insulin-sensitising properties (Patocka et al., 2024). In addition, some compounds contained in *A. mexicana*, in particular 6-acetonyldihydrochelerythrine, have significant in vitro anti-HIV activity. The plant extract also has antioxidant properties and potential antiviral activity, including inhibition of the RNA polymerase of SARS-CoV-2 (Patocka et al., 2024; Adodo and Iwu, 2020).

However, *Argemone mexicana* also has high toxicity. This is mainly due to the presence of sanguinarine, chelerythrine, dihydrosanguinarine, and protopine. These compounds have a negative effect on the liver and nervous system (Carlomagno et al., 2015; Alonso-Castro et al., 2017). It has been observed that the highest concentrations of toxic compounds are found in the seeds and seed oil. An overdose of the plant can lead to neurotoxicity, paralysis, dermatitis and abortifacient effects. In extreme cases, poisoning can result in paralysis of the central nervous system, which can lead to death. This corresponds to the symptoms described by traditional healers (Watt and Breyer-Brandwijk, 1932; Germosén-Robineau, 2014). Sanguinarine and chelerythrine are particularly hepatotoxic when consumed in excessive amounts, leading to liver damage and contributing to jaundice (Alonso-Castro et al., 2017). Even though berberine is known for its beneficial properties, it can also be toxic in high doses, negatively affecting circulation and causing paralysis of the central nervous system (Watt and Breyer-Brandwijk, 1932).

In addition to its importance in medicine, research has shown that the oil-rich seeds of *A. mexicana* can be used as a source of biodiesel, which further increases the plant's industrial potential (Yadav et al., 2018).

Aspilia mossambicensis (Oliv.) Wild

Family:

Asteraceae Bercht. and J.Presl

Synonyms:

Seruneum mossambicense (Oliv.) Kuntze, *Wedelia mossambicensis* Oliv., *Aspilia holstii* O.Hoffm., *Wedelia abyssinica* Vatke

Vernacular names:

Ethiopia (Sheko): Kershu; **Kenya** (Borana): Aatha; **Kenya** (Digo): Muhepe, Mutanzi, Mulepe; **Kenya** (Dorobo, Suiei): Loiyapasei; **Kenya** (Kamba): Muti; **Kenya** (Luhya): Lilelia, Lilelie; **Kenya** (Luo): Rayetigo; **Kenya** (Tharaka): Muuti; **Kenya** (Turkana): Echekekuyan; **Somalia**: Lubaanduureed; **Tanzania**: Kanyamuza, Suruwa; **Tanzania** (Hehe): Kisengelavahinza; **Tanzania** (Haya): Eshurwa; **Tanzania** (Luo): Rayetigo; **Tanzania** (Maasai): Ol ojabassej; **Tanzania** (Pare): Mshayasha ngozo; **Tanzania** (Shambaa): Njanga-njangala, Nyanganyanga; **Tanzania** (Sukuma): Ihwula; **Tanzania** (Zigua): Mgeregere; **Uganda** (Busoga): Mubiawawala; **Uganda** (Karimojong): Ekuyon; **Uganda** (Luo): Rayetigo; **Uganda** (Minziro, Sango Bay): Lushulwe; **Uganda** (Nyankore): Eraji.

Conservation value: –

Distribution:
The native range of this species extends across the Arabian Peninsula (Yemen) and eastern and southern Africa, from Eritrea and Sudan in the northeast to the southern regions of the continent (POWO, 2025).

Habitat:
Aspilia mossambicensis commonly occurs in ruderal sites, disturbed areas, seasonal swamps, along rivers and lakes, forest margins, woodlands, wooded grasslands, bushland, and open grasslands. It is highly adaptable and thrives across a wide altitudinal range from 45 to 2,300 metres a.s.l., often found in both moist and moderately dry environments (Beentje et al., 2005).

Invasiveness: -

Ethnobotany:
Cultural and traditional uses: *Aspilia mossambicensis* is mainly used for traditional medicinal purposes. In Somalia, the fresh roots are boiled with Boswellia gum resin to make a decoction used to treat gonorrhoea. To achieve the desired effect, the remedy is supposed to be consumed three times a day for three days (Samuelsson et al., 1992). The roots of the plant are also valued for their effectiveness in the treatment of cystitis and as a lactation stimulant. *A. mossambiciensis* is also used as a wound-healing aid. A paste made from the crushed leaves is applied to fresh wounds. The leaves are also rubbed on the skin to treat ringworm. Furthermore, Somali healers use a decoction of the leaves to treat intestinal parasites. During the cooking process, the vapours are inhaled to alleviate hookworm infections. Other preparations traditionally used in Somali medicine include a bark decoction to relieve back pain, and plant sap, consumed hot or cold, to relieve stomach pain. This plant, in combination with *Hymenodictyon parvifolium*, is also used to treat eclampsia due to its diaphoretic effect (Samuelsson et al., 1992).

Among the Ugandan Baganda people, a decoction of the leaves and roots is a popular remedy for malaria and fever, which is also taken three times a day for three days. This remedy is not recommended during pregnancy. A strong decoction of the whole plant, taken in measured doses, is also said to be effective against ascariasis. As in Somalia, the plant is also used as a wound-healing agent. In this case, however, the leaves are mixed with *Hoslundia opposita* and ash before being applied under a bandage that is changed daily. In addition this method, the juice squeezed from fresh plant leaves is also used directly on wounds to prevent infection (Hamill et al., 2003). In both Kenya and Uganda, the plant is valued for the treatment of skin infections. In this case, a topical preparation is made by pounding the leaves of the plant together with oil (Kokwaro, 1987).

The Washambaa people of Tanzania traditionally use a decoction of the root of *Aspilia mossambicensis* to relieve back pain, sciatica, and neuralgia (Bally, 1938). Here, too, the is used in the prevention of eclampsia. For this purpose, the Wapare people prepare a steam bath using a mixture of *Aspilia mossambicensis* and *Hymenodictyon parvifolium*. According to the Swiss botanist Peter R. O. Bally, who conducted botanical research in the region at the beginning of the twentieth century, this bath was

taken under a cover of skins and leaves. It caused profuse sweating, after which the patients were washed with a cooled decoction of the plant (Bally, 1938). Among the Haya community, a mixture of the above-ground parts of *Aspilia mossambicensis* and *Centella asiatica* is boiled and the resulting decoction is used as a remedy for malaria. In addition, this plant is used as a tonic with hypoglycaemic properties (Moshi et al., 2009). Preparations made from the leaves of *Aspilia mossambicensis* are also often given to Tanzanian children to promote growth. In addition to the above, there are also reports that the plant is used to bathe children suffering from convulsions, to relieve their symptoms (Quattrocchi, 2012; Hilonga et al., 2019).

Moving to Kenya, the Tharaka people commonly use the leaves and roots of *Aspilia mossambicensis* to treat stomach ache, coughs, pneumonia, and yellow fever (Kaigongi and Musila, 2015). The plant's sap is also used as a coagulant to promote wound healing. Meanwhile, in Mozambique, the roots of *Aspilia mossambicensis* are highly valued and used to treat tuberculosis (Sitoe, 2020). In this case, the roots of the plant are first dried and then placed on glowing coals, the smoke of which is to be inhaled by patients covered with a blanket (Pennacchio et al., 2010). On a slightly different note, in Ethiopia, the Sheko people use *Aspilia mossambicensis* primarily to treat ear infections. For this purpose, the fresh leaves of the species are crushed and applied to the affected area (Giday et al., 2010). This practice is also observed in the Yeki district, where crushed leaves are a common remedy for ear ailments (Awoke et al., 2024).

In addition to its medicinal uses, *Aspilia mossambicensis* also plays an important role in African pastoral and ethnoveterinary practices. The Maasai consider the plant to be a highly valued forage during the dry season. During this period, the Maasai herd their cattle to areas of its abundant growth. They believe that eating it keeps the cattle healthy and in good condition (Merker, 1910). Similarly, in Kenya, this plant is one of the most favoured local fodder species. Farmers value its palatability to livestock, its ability to improve animal condition, and its drought

resistance (Roothaert and Franzel, 2001). In addition to its use as animal feed, *Aspilia mossambicensis* is traditionally used in East Africa to treat anaplasmosis in cattle. The preparation involves boiling a handful of *Aspilia mossambicensis* roots and fruits together with four *Solanum nigrum* berries in water. The extract obtained in this way is administered to sick animals by sprinkling it over them (Dharani et al., 2015). Among the Karamojong people, a water extract of the leaves and roots of *A. mossambiciensis* is used to treat East Coast fever (theileriosis) in livestock. Usually, it is administered together with the fruit of *Solanum incanum* (Gradé et al., 2009).

Scientific perspective: Despite its wide range of uses in traditional African medicine, scientific research into the phytochemistry and pharmacological properties of *Aspilia mossambicensis* is still limited. Preliminary studies report that the plant has medicinal potential owing to the presence of compounds such as tiarubrine A and tiarubrine B, two secondary metabolites. Both compounds exhibit strong antibiotic, antifungal, antiviral and phototoxic activities (Samuelsson et al., 1992; Johns, 1996). These compounds may contribute to the plant's effectiveness in treating skin and respiratory tract infections, however, further research into the phytochemistry of this plant is recommended.

Astripomoea grantii (Rendle) Verdc.

Family:
Convolvulaceae Juss.

Synonyms:
Astrochlaena grantii Rendle, *Astrochlaena ugandensis* Rendle, *Ipomoea ugandensis* (Rendle) J.R.I.Wood and Scotland

Vernacular names:
Congo (Bushi, Shi, Sud-Kivu): cimenwa, cinenwa, nfumbia likasi; **Rwanda** (Gisenyi): umutakampungwe; Rwanda (Kinyarwanda): umuháto, umutakampungwe; **Somalia** (Somali): Ghed-hiyat; **Uganda** (Luganda): mukuzanyara; **Uganda** (Western region): mukuzanyara.

Conservation value: –

Distribution:
The native range of this species is in East-Central and East Tropical Africa, including Burundi, Kenya, Rwanda, Tanzania, Uganda, and the Democratic Republic of the Congo (POWO, 2025).

Habitat:
Astripomoea grantii typically inhabits open and disturbed environments such as grasslands, bushlands, rocky areas, and roadsides. It occurs at moderate elevations, ranging from approximately 1,200 to 1,920 m a.s.l. (Verdcourt, 1963; POWO, 2025).

Invasiveness: –

Ethnobotany:
Cultural and traditional uses: *Astripomoea grantii* is traditionally used exclusively for medicinal purposes. In the Rwandan region of Gisenyi, pregnant women drink a decoction made from the leaves of *Astripomoea grantii*, *Aloe macrosiphon* and *Clerodendrum formicarum* once a month. This decoction is said to have a general strengthening effect and to have a positive effect on the well-being of pregnant women (Kayonga and Habiyaremye, 1987). In the western regions of Uganda and in the districts of Bushenyi and Kasese, the plant is used by midwives as a labour-inducing agent. To this end, they extract the sap by crushing the leaves. The sap is then administered orally (Kamatenesi-Mugisha and Oryem-Origa, 2007; Maroyi, 2021). In addition, *Astripomoea grantii* is known in traditional Kenyan medicine as a remedy for colds, fever, headaches, and malaria (Maroyi, 2021).

Astripomoea grantii is also used in ethnoveterinary practices. For example, in the Bushi, South Kivu and Kivu regions of the Democratic Republic of the Congo, animal breeders use crushed leaves mixed with kaolin as an anti-inflammatory agent applied externally to treat mastitis (Defour, 1994). A paste made from *Astripomoea grantii* and *Cryptolepis oblongifolia*, *Hypericum revolutum*, *Pteris similis*, *Lactuca attenuate*, and *Sonchus asper*, mixed with clay, is applied in the same way. This paste is massaged into the swollen mammary glands to relieve the symptoms of mastitis (Chifundera, 1998; Maroyi, 2021). In addition, macerated leaves are used to treat anaplasmosis in animals. The leaf sap, in turn, is used as nose and ear drops to treat anthrax in animals (Chifundera, 1998; Maroyi, 2021).

Scientific perspective: Scientific research has demonstrated the antibacterial and antifungal properties of *A. grantii* extracts. The plant extracts have been tested for activity against Kaposi's sarcoma-associated herpesvirus (KSHV). The results of these studies have shown the plant's promising antiviral potential, but due to lack of further research, the plant's full healing potential is still unknown (Maroyi, 2021).

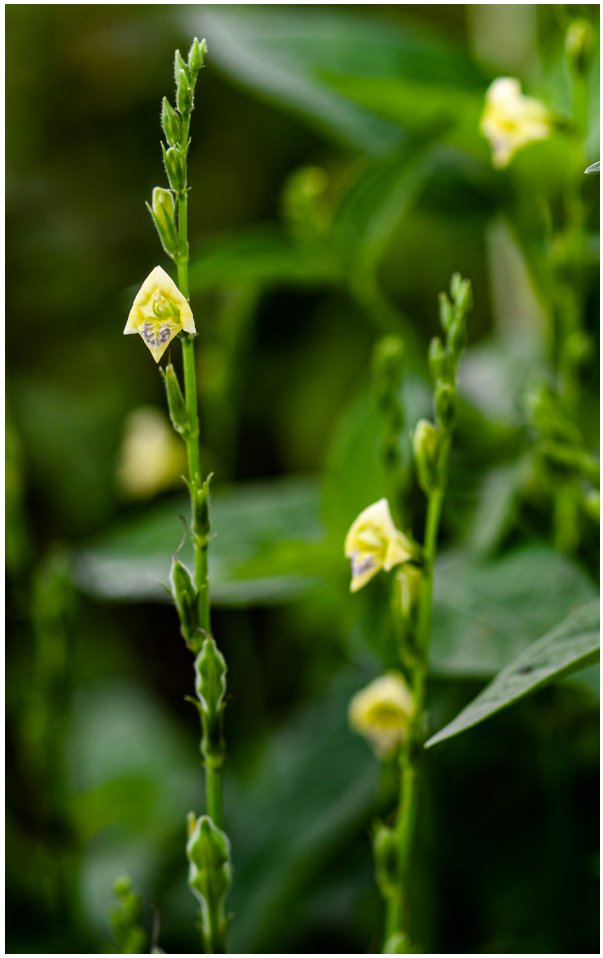
Asystasia gangetica (L.) T.Anderson

Family:
Acanthaceae Juss.

Synonyms:
Justicia gangetica L., *Ruellia gangetica* (L.) R.Br., *Asystasia coromandeliana* Nees

Vernacular names:
Angola (Portuguese): Asistasía branca; **Australia** (English): Asian Coromandel, Chinese violet, Creeping foxglove, Asystasia; **Austria** (German): Chinesisches Veilchen;

Bangladesh (Bengali): গঙ্গাতারা (Gangatara); **Benin** (Adja): Liman; **Benin** (Adja, Watchi): Essouto, Elinman; **Benin** (Aïzo): Degnuman; **Benin** (Anii): Atchelekman; **Benin** (Fon): Azéman, Azema; **Benin** (Goun): Yéfè; **Benin** (Gourmantché): Pobouanga/Pobunga; **Benin** (Holly): Akoussimekpe/Okoussoumèkpè; **Benin** (Kotokoli): Egbedoudou; **Benin** (Wama): Kouwôkouma; **Benin** (Yoruba, Nagot): Lobiri; **Benin, Nigeria** (Yoruba, unspecified region): Abesukale, Ila funfun, Lobiri, Obo esin, Sobohee funfun; **Brazil** (Amazon region, Portuguese): Asistasia-branca; **Brazil** (Portuguese): Coromandel; **Burundi** (Kirundi): Urusogo; **Cameroon** (Babungo): Formenshi; **Cameroon** (Ejagham, Bafou/West Cameroon region): Basu ebu; **Central African Republic** (Banda, Lingala, Lisongo): Kaka du, Oyo bada, Nginze, Ndedji, Remède du bada; **Colombia** (Spanish): Campanilla; **Democratic Republic of Congo** (Walungu, Mashi, Kirega, Shi, Kinyarwanda, Kr, Ts): Irungo, Olokoshi, Oiokoshi, Musawa, Ijojwe, Urusogo; **Finland** (Finnish): Peittokirjosuu; **Gabon** (French): Herbe à lierre; **Germany** (German): Chinesisches Veilchen; **Ghana** (Akan-Twi): Fiangoro, σbσfo fan; **Ghana** (Dagbani): N'chendua; **Guinea-Bissau** (Balanta, Bijagós, Mandinka, Susu): M'totn, Candô, Candindjaon, Funkundunkutxi; **India** (Tamil, Kannada, Telugu, Malayalam): Corri, Lavangavalli, Maithaala kaddi, Medde soppu, Meddhe soppu, Mitikirai, Mooguthi gida, Pacconti, Paccorri, Paccottinkirai, Paccurri, Paccutti, Palcorrikkirai, Palvatintan, Panacakkoti, Paralaukikam, Paralelakkam, Parcorri, Parcorrikkirai, Parcurri, Patunayaki, Patuvanayaki, Payacakkoti, Poda beera, Porrikkirai, Tappeta, Valli-upu-dali, Valukka kirai, Venna kattethige; **India** (Tamil Nadu): Valukai keerai; **Indonesia** (Indonesian): Rumput Israel; **International** (Chinese): 宽叶十万错 (Kuān yè shí wàn cuò), 赤道樱花 (Chì dào yīng huā), 十万错 (Shí wàn cuò), 亚西达 (Yà xī dá), 跌打草 (Diē dǎ cǎo), 寬葉十萬錯 (Kuān yè shí wàn cuò), 赤道櫻草 (Chì dào yīng cǎo), 小花十萬錯 (Xiǎo huā shí wàn cuò), Kaw kua chai; **International** (English): Asian Coromandel, Chinese violet, Creeping foxglove, Asystasia; **International** (French): Herbe le rail, Mange-tout, Herbe pistache, Pistache marron; **International** (Russian): Азистазия гангская (Azistaziya gangs'kaya); **Japan** (Japanese): ツノグサ (Tsunogusa), コロマンソウ (Koromansou); **Kenya** (Digo): Mforfor; **Kenya** (multiple languages): Atipa, Burutula, Enkosida, Fuchwe, Futsure, Futswe, Gosida, Mtikini, Tala-kushe, Turkwot, Vongonya; **Kenya, Tanzania** (Maasai): Ol osidja gutok; **Liberia** (Mano): Namu; **Lithuania** (Lithuanian): Indinė asistazija; **Malaysia** (Malay): Rumput Israel, Rumput bunga putih, Rumput hantu, Rumput nyonya, Akar ruas ruas, Ara songsang, Asytasia; **Mauritius** (French, French Creole): Pistache marron, Herbe pistache; **Mozambique** (Portuguese): Asistasía branca; **Myanmar** (Burmese): Kyauk-kwe, Kyauk-hkwe; **Nigeria** (Edo): Ebe ogboghiro, Èbóghògíró, Òvbiàkpè; **Nigeria** (Efik): Ọ̀miọ̀n°; **Nigeria** (Ibibio): M̀mèmé; **Nigeria** (Igbo): Ékèrè; **Nigeria** (Igbo-Agukwu): Ùlì ókō; **Nigeria** (Igbo-Owerri): Ìkéré; **Nigeria** (Ijo-Izon-Kolokuma): Bèrìbà ị̀gbá, Ọ̀kúr̀ọ́, Ọ̀bìrì òwéí; **Nigeria** (Yoruba): Lobiri, Oseta, Ila funfun; **Philippines** (Tagalog): Asistasia/Asistasiya, Bulak-bulak, Zamboangenita; **Portugal** (Portuguese): Coromandel; **Republic of Congo** (Téké, Beembe, Koyo, Mbosi): Ondôh, Mounpoukou, Ondoko, Ondo; **Senegal** (Diola, Wolof): Édiul, Géediul, Omigalin, Umégarin; **Senegal** (Diola-Flup,



Diola-Oussouye): Hédul; **Sierra Leone** (Kissi): Kɔlɔ; **Sierra Leone** (Loko): Kɛrɛge, Pɛrɛge; **Sierra Leone** (Manding-Maninka-Koranko): Tɛgɔlo; **Sierra Leone** (Mende): Legbule, Lelegbule; **Sierra Leone** (Temne): A-puth; **South Africa** (English): Asystasia, Creeping foxglove; **Spain** (Spanish): Campanilla; **Sri Lanka** (Sinhala): රිලා පුරුක් (Rilā puruk); **Sri Lanka** (Tamil): Peypatchotti; **Tanzania** (Haya people, Bugabo region): Ekiingura, Kinyegezi; **Tanzania** (Swahili): Fuchwe, Mtikini, Kichwamangwo; **Thailand** (Thai and local dialects): บาหยา (Bā yā), ย่าหยา (Yā yā), อ่อมแซบ (Ōm saep/Ōm sap), เบญจรงค์ห้าสี (Bencharong hā sī); **The Gambia** (Manding-Mandinka): Anamala; **Uganda** (Luganda): Ttemba; **Vietnam** (Vietnamese): Biến hoa sông hằng, Thập vạn thác.

Conservation value: –

Distribution:

The native range of this species extends from the Indian subcontinent to northern and eastern Australia, including Southeast Asia and parts of Malesia. It has been widely introduced and is now naturalised in many tropical and subtropical regions worldwide, including the Americas, Africa, the Pacific Islands, parts of China, and various Indian Ocean islands (POWO, 2025).

Habitat:

Asystasia gangetica typically inhabits disturbed areas such as roadsides, old farmlands, croplands, grasslands, dunes, and stream banks, but is also found in woodlands, riverine forests, and as a herb in undisturbed forest environments. It occurs from sea level up to 2,500 m, particularly within the Indian Ocean Coastal Belt, Sub-Escarpment Savanna, and Indigenous Forests. The species is widespread in tropical and subtropical regions, including urban areas, cultivated lands, and semi-waterlogged zones. It grows well on coastal alluvium, sandy loams, clay soils, and peat soils with high organic matter (~85%) and a highly acidic pH (3.5–4.5) (Adetula, 2004; Rojas-Sandoval and Acevedo-Rodríguez, 2012; GlobinMed, 2021; Fern, 2025; WFO, 2025).

Invasiveness:

With its ability to reproduce by vegetative propagation and form dense vegetation mats, this species can be highly invasive. It can smother neighbouring vegetation with its herbaceous layer. Its introduction to the Pacific Islands has caused major disruptions in native ecosystems (GISD, 2025d). For example, it is an invasive species spreading in natural or semi-natural environments at a moderate density, but not yet dominating or co-dominating the vegetation in Mayotte (Barthelat, 2005) and Réunion (CBNM, 2007).

Ethnobotany:

Cultural and traditional uses: *Asystasia gangetica* is used in many different traditional ways, especially in African cultures. In terms of culinary use, the plant is occasionally eaten as a leaf vegetable in Benin. However, it is not as popular there as other traditional wild vegetables. Nevertheless, it is included in the diet of the Gourmantché and Anii communities in northern Benin, as well as the Adja, Aïzo, and Holly groups in the south of the country. The plant is harvested during the rainy season and occasionally sold at markets (Achigan-Dako et al.,

2010). In Kenya and Uganda, *Asystasia gangetica* is particularly valued during periods of food scarcity. In traditional cuisine, it is usually prepared with other leafy vegetables, beans, peanuts, or sesame paste, which improves both taste and nutritional value of the dish (Bussmann et al., 2021). In Malaysia, the young shoots of this plant are considered a traditional vegetable. The shoots are usually eaten both cooked and raw. They are also added to fish and meat dishes. Despite the lack of distinct flavouring qualities, the plant is valued there for its nutritional content (Saidin, 2000). It is also used in the same way in Thai cuisine, as has been confirmed in the villages of Ban Don Wiang Chan and Ban Hua Khua in the Kantarawichai district (Saensouk et al., 2024). Amongst indigenous Indian groups, the plant is also used in local culinary traditions. Members of the Paliyar tribe from Tamil Nadu cook *Asystasia gangetica* leaves with caraway seeds and onions. This dish is said to increase the appetite of the sick (Ignacimuthu et al., 2006). The Irula people of the Western Ghats, on the other hand, consume the leaves of this species raw or in the form of a decoction (Venkatachalapathi et al., 2018). The leaves are also part of the local diet in Myanmar. They are generally used in salads after blanching (Zhang et al., 2022). In southern China, in regions such as Hainan Province, the young shoots and leaves of the plant are stir-fried and then eaten individually or added to other dishes (Xu et al., 2020b).

Simultaneously, *Asystasia gangetica* is used across all the above regions in traditional medicine. Members of the Bafou tribe in Cameroon use its fresh mashed leaves as a poultice on wounds. This poultice is said to accelerate healing and reduce the risk of infection (Ngueguim et al., 2012). The Balanta and Mandinka people in Guinea-Bissau also use leaf poultices on wounds (Catarino et al., 2016). The Banda and Lingala people in the Central African Republic use the charred stems of *Asystasia gangetica* to treat scabies. To do this, they mix the ash obtained with oil and apply the resulting ointment to the affected areas (Vergiat, 1969). The plant is also traditionally used externally in Nigeria. Leaf

poultices are applied topically to relieve rheumatic pain, stomach pain, and skin ailments (Chopra et al., 1933; Kokwaro, 1976). Similarly, in Mauritius and Guinea-Bissau, the plant is recognised as an effective anti-inflammatory agent, used primarily for rheumatism, oedema, wounds, and inflammation (Catarino et al., 2016; Suroowan et al., 2019). Furthermore, the use of *Asystasia gangetica* for skin complaints is common in Asia. In Myanmar and the Philippines, the plant is used to treat injuries and skin infections (Balick, 2009; Zhang et al., 2022; San San Maw and Kyi Kyi Sein, 2023). In Vietnam, it is also used as a poultice on bruises to reduce swelling and inflammation (Catarino et al., 2016). In China, *Asystasia gangetica* is known as 跌打草 (Diē dǎ cǎo), which means 'injury herb'. It is also used there in the form of a poultice to reduce swelling and bruising, as well as to relieve migraines (Pan and Huang, 2013). Interestingly, in China, as in the Central African Republic, it has been noted that the burnt above-ground parts of the plant are mixed with oil to make an ointment for the treatment of scabies. This practice is particularly common in southern China among the Zhuang ethnic group (Xu et al., 2020b).

In some regions of Africa, *Asystasia gangetica* is known as a remedy for musculoskeletal disorders. The Bashi people of the Democratic Republic of the Congo use a paste made from the plant for sprains, fractures and dislocations (Chifundera, 2001). The plant is used in the same way by the Bafou people of Cameroon (Ngueguim et al., 2012). In India, specifically in Dakshina Kannada, Karnataka, the leaves and stems are ground with rice water and applied as a hot paste to relieve painful sprains (Yogeesha and Krishnakumar, 2022).

Another widely practised method of using *Asystasia gangetica* is to treat digestive ailments. In Cameroon, a decoction of the plant is used to treat gastrointestinal disorders (Kellé et al., 2023). In Guinea-Bissau, a decoction of the flowers and stems is also used to relieve stomach pain and intestinal disorders (Catarino et al., 2016). In Malaysia, specifically in Terengganu, a decoction of *Asystasia gangetica* leaves is used to relieve constipation (Zakaria et al., 2020). Among the Paliyar tribes of Tamil Nadu, fresh leaves with caraway seeds and onions are used for stomach problems to increase appetite (Ignacimuthu et al., 2006). The juice of the plant is also used to stimulate appetite among the Haya people of Tanzania (Moshi et al., 2009).

In addition, the plant is used to treat respiratory diseases. In Mauritius, a decoction of the dried plant is consumed to treat bronchitis, colds and other lung infections (Suroowan et al., 2019). In Nigeria, the leaves of this species are used as a remedy for asthma (Chopra et al., 1933; Kokwaro, 1976). In many Asian countries, *Asystasia gangetica* is used to treat respiratory diseases. Ayurvedic and Siddha medicine in India recommend a drink made from the plant's sap mixed with lime juice and onion as a remedy for dry coughs, sore throats and lung problems (Burkill, 1985). The juice of this plant is used to relieve respiratory ailments among the Irula tribes in the Western Ghats (Venkatachalapathi et al., 2018). The plant's expectorant and anti-inflammatory properties are used in Malaysia, where a decoction of the whole plant is drunk to alleviate lung infections and bronchitis (Zakaria et al., 2020).

Another category of the plant's use in traditional medicine relates to its role in obstetrics and in maintaining reproductive health. In Cameroon, the Ejagham people use infusions of the plant as a means of regulating menstrual cycles (Njamen et al., 2013). Similarly, in India, Ayurvedic and Siddha practitioners administer the plant in cases of irregular menstruation (Venkatachalapathi et al., 2018). The Bafou people, by contrast, use *Asystasia gangetica* to increase female fertility (Ngueguim et al., 2012). In Ghana, a decoction of the plant is administered with chilli as an enema during advanced pregnancy to alleviate labour pains and facilitate delivery (Abbiw, 1990). The use of *Asystasia gangetica* to treat cardiovascular and nervous system diseases has also been reported in several regions. In Équateur province of the Democratic Republic of the Congo, an aqueous

extract of 20 leaves mixed with pineapple or sugar cane juice is used to treat heart palpitations (Konda ku Mbuta et al., 2012). Meanwhile, in Goma, the plant is used to treat cardiopathy and mental disorders such as epilepsy and anxiety (Konda ku Mbuta et al., 1992; Kyolo et al., 2022).

Furthermore, the species is known for its detoxifying and kidney-supporting properties. An infusion of the plant is used to relieve kidney pain in Benin (Dansi et al., 2008b; Achigan-Dako et al., 2010). In Mauritius, decoctions of the plant are consumed to relieve discomfort when urinating (Suroowan et al., 2019). In Myanmar, within traditional Asian medicine, the plant is widely used to treat kidney diseases. Moreover, it is used to treat urethritis, gonorrhoea, and other urinary tract disorders (San San Maw and Kyi Kyi Sein, 2023; Zhang et al., 2022). Among the Karen people in the village of Wah-Theinkha, a decoction of the plant is prescribed for urolithiasis (kidney stones) (Zarli et al., 2021). Similarly to Mauritius, similar to Mauritius, a decoction of the plant is consumed in Malaysia to relieve painful urination (Zakaria et al., 2020). Other uses of *Asystasia gangetica* in traditional medicine have also been reported. In Uganda, crushed plant flowers are diluted in water to prepare a cooling bath for children suffering from fever (Tugume et al., 2016). The plant is also used to treat snakebites (Burkill, 1985).

Traditional use *of Asystasia gangetica* in folk medicine is less documented in the Americas due to its later introduction. However, it has also been used there for medicinal purposes. For example, the plant is currently cultivated in French Guiana because of its medicinal properties for wound healing and infection prevention (Hoff and Cremers, 2005). Meanwhile, on the Micronesian island of Pohnpei, the plant has gained recognition not only for its healing properties, but also protective qualities. Its flowers are there commonly used to make mwaramwar (ceremonial head wreaths) (Balick, 2009).

In terms of ethnoveterinary use, the plant is widely used among pastoral communities in Kenya and Tanzania. The Maasai traditionally pound the plant and soak it in water. This rinse is then poured over young livestock to protect them from fleas (Merker, 1910; Bussmann et al., 2021). *Asystasia gangetica* is also used as animal feed, both cultivated and cut for hay in Asia. However, its use as fodder requires attention, as excessive consumption by animals can lead to bloat (Burkill, 1985; Bussmann et al., 2021).

In terms of other uses, the plant is valued in The Gambia as a natural substitute for soap due to its ability to produce foam when mixed with water (Burkill, 1985). In Benin, the plant is associated with spiritual beliefs and practices. It is therefore planted near houses and burned in purification rituals. The smoke it produces is believed to ward off evil spirits and negative energy. Similarly, in

Gabon, it is used to prepare ritual baths to cleanse those suffering from various spiritual ailments (Quiroz, 2015). In the Takamanda Forest Reserve, the Anyang and Basho people sow the plant around their houses and even make amulets out of it to protect them from witchcraft (Zapfack et al., 2001). In the Congo, *Asystasia gangetica* is used in therapeutic massages. Its leaves are ground with palm oil, *Cassia occidentalis*, and *Schwenckia americana*. The resulting mixture is applied to the body and is said to have muscle-relaxing and pain-relieving properties (Adjanohoun et al., 1988).

Scientific perspective: A 100 g portion of fresh *Asystasia gangetica* contains 205 mg of calcium, 7-8 mg of iron, vitamin A (7615 IU), vitamin B1 (1.16 mg), vitamin B2 (0.20 mg) and vitamin C (53 mg) (Saidin, 2000). Phytochemical analysis confirmed the presence of flavonoids, alkaloids, glycosides, coumarins, tannins, steroids, terpenoids, and saponins. The high carbohydrate, protein, and lipid content justifies its use as a food source in times of food shortage (Gopal et al., 2013). Current studies indicates that *Asystasia gangetica* has significant antiparasitic activity. A dichloromethane:methanol extract from the stems with a concentration of 9.7 µg/mL inhibited the growth of *Plasmodium falciparum* by 40% (Bussmann, 2021). Additionally, the iridoid glycoside ajugol showed an IC50 of 31.8 µg/ml against *Trypanosoma brucei rhodesiense* and 7.2 µg/ml against *Leishmania donovani* (Bussmann, 2021). In addition, the methanol extract showed inhibition of protein denaturation - an in vitro proxy for anti-arthritic activity. The results indicated that the extract inhibited denaturation by 78.94% at the highest concentration (1000 µg/ml), which is comparable to diclofenac sodium (Gopal et al., 2013).

Other studies also confirm the antimicrobial effectiveness of *Asystasia gangetica* against Staphylococcus aureus and *Escherichia coli* in in vitro tests (Kellé et al., 2023). These findings suggest that the plant may be effective in treating skin infections and gastrointestinal disorders (Catarino et al., 2016). Furthermore, extracts from *Asystasia gangetica* have shown promising gastroprotective effects in preclinical studies, which may be important in the treatment of ulcers and general gastrointestinal health. They appear to reduce gastric acid secretion while strengthening mucosal defence (Kellé et al., 2023). Finally, the high flavonoid and phenolic content of the plant gives it strong antioxidant and anti-inflammatory properties (Zhang et al., 2022).

Axonopus compressus (Sw.) P. Beauv.

Family:
Poaceae Barnhart

Synonyms:
Agrostis compressa (Sw.) Poir., *Echinochloa compressa* (Sw.) Roberty, *Milium compressum* Sw., *Paspalum compressum* (Sw.) Raspail, *Paspalum compressum* (Sw.) Raspail, *Axonopus jesuiticus* (Araujo) Valls

Vernacular names:
Argentina (Spanish): Grama brasileña, Nudillo, Zacate amargo, Pasto chato, Pasto jesuita, Pasto alfombra, Pasto de los jesuitas, Forrajera, Perenne, Grama misionera; **Argentina** (Mbya Guaraní community): Kapi'i pe; Bangladesh (Bengali): Shial kata; **Benin** (Kweni): Tunétunénègo; **Bolivia** (Spanish): Nudillo; **Brazil** (Portuguese): Capim-cabain, Capim-três-forquilhas, Capitinga, Grama-argentina, Grama-missioneira, Grama-sempre-verde, Grama-tapete, Capim-cabaiu; **Colombia** (Spanish): Grama trenza; **Colombia** (Caldas): Alfombra, Gramilla rastrera, Pasto comina; **Colombia** (Chocó): Camina-con-pie, Gateadora morada, Grama horquetilla; **Colombia** (Casanare): Grama, Grama blanca, Grama criolla; **Colombia** (Atlántico): Grama extranjera de hoja ancha; **Colombia** (región andina): Horquetilla; **Colombia** (Bolívar): Panza de burro; **Colombia** (Meta, Tolima): Pasto natural; Colombia (Cauca,

Nariño): Tembladora; Côte d'Ivoire (Kweni): Tunétunénègo; **Cuba** (Spanish): Cañamazo, Cañamazo de sabana, Cañamazo macho, Cáñamo, Canutillo; **Cuba** (Lukumi): Ogbo; **Fiji** (Fijian): Kambutu ni vavalangi; **Guyana** (English): Carpet grass; **Hong Kong** (Chinese): 地毯草 (Di tan cao); **Indonesia** (Indonesian): Rumput, Rumput bulu ayam, Djoekoet pahit, Djukut pait, Roempoet pait, Rumput pahit, Jukut pahit; **Indonesia** (Dayak Kerabat): Rumput taik sapi; **International** (Chinese): 地毯草 (Di tan cao); **International** (English): Carpet grass, Lawn grass, Blanket grass, Louisiana grass, Broadleaf carpet grass, Flat grass, Savannahgrass, Tropical carpet grass, Flat jointgrass, American carpet grass, Dorrington grass, Wide-leaved carpet grass; **International** (French): Axonope, Herbe gazon, Buffalo américain, Herbe de la Louisiane; International (German): Teppichrasengras, Breitblättriges, Breitblättriges Teppichrasengras; **International** (Portuguese): Grama-são-carlos, Grama-jesuíta, Gramão; **International** (Spanish): Baracoa, Cardo santo, Grama, Nudillo, Pasto chato, Pasto jesuita, Zacate amargo, Grama tapete, Pasto alfombra, Alfombra, Grama trenza; **Japan** (Japanese): ツルメヒシバ (Tsurume-hishiba); **Macau** (Chinese): 地毯草 (Di tan cao); **Malaysia** (Malay): Rumput Karung, Rumput parit; Nepal (Nepali): Chaure ghans; **Nicaragua** (Spanish): Baracoa; Nigeria (English): Blanket grass; **Nigeria** (Yoruba): Idi; Peru (Ucayali region, Spanish): Turulco; **Philippines** (Filipino): Kulape; Sierra Leone (Fula-Pulaar): Fɔnyɛ-brurɛ; **Sierra Leone** (Gola): Jani, Yani; **Sierra Leone** (Kissi): Kotokpo, Tandamaneyo; **Sierra Leone** (Kono): Kpaŋgba, Kpaŋgba-tava, Yani; **Sierra Leone** (Loko): Nika-yani; Sierra Leone (Mende): Boni, Yani; **Sierra Leone** (Temne): Ka-yan; **Sierra Leone** (Yalunka): Kharutu-na, Sɛrkha-na; **Sri Lanka** (Sinhala/Tamil): Potu-tana, Sappu pul, Pothu tana; **Suriname** (Dutch): Beschuitgras; **Suriname** (Saramaccan): Bosu pata ahu; **Suriname** (Sranan Tongo): Buskutugrasi; **Taiwan** (Chinese): 地毯草 (Di tan cao); Thailand (Thai): หญ้ามาเลย์ (Ya Malay), Ya baimaln, Ya-help; Vietnam (Vietnamese): Cỏ lá gừng.

Conservation value:

Least Concern - LC (IUCN, 2025)

Distribution:

The native range of this species includes tropical and subtropical regions of the Americas, from the south-eastern United States through Central America, the Caribbean, and much of South America. It has been widely introduced and naturalised across tropical Africa, Asia, and the Pacific, including parts of China, India, Southeast Asia, and numerous Pacific and Indian Ocean islands (POWO, 2025).

Habitat:

Axonopus compressus occurs in moist, open, and disturbed habitats such as grasslands, field margins, roadsides, open woodlands, and shrubby slopes. It is widely naturalised in tropical and subtropical regions, from sea level to 3,000 m a.s.l., with its best development in lowland areas. The species prefers well drained to moderately drained sandy or loamy soils, but also tolerates light clays and peats, and is best suited to acidic soils (pH 5.0–6.5). It is intolerant

of drought and prolonged flooding, though it tolerates high annual rainfall (1,000–4,000 mm). In agricultural landscapes, it often establishes along irrigation ditches, bunds, and margins of rice fields. It has been recorded as a weed in rice fields in the Philippines (Lubigan and Moody, 1987), and is also considered a common weed in young plantations of rubber, oil palm, coffee, citrus, and other tropical crops (CABI, 2019; Cook et al., 2020; WFO, 2025).

Invasiveness: -

Ethnobotany:

Cultural and traditional uses: For centuries, *Axonopus compressus* has been recognised as a valuable fodder plant (Hitchcock, 1921). In Argentina, the grass is a popular cattle feed plant in Misiones. Similarly, in Colombia, *Axonopus compressus* is an important component of traditional pastures. In Brazil, the grass is used as fodder in zebu farms, which is said to contribute to their weight gain (Rahman et al., 2014). Also in Cuba, it is an important part of pastures, especially in open plains, where it can survive despite large fluctuations in soil moisture (Pérez-Arbeláez, 1956). On the African continent, *Axonopus compressus* is also known for its fodder potential. In Nigeria, it serves as a permanent source of feed for buffaloes, cattle, goats, and sheep, especially during the dry season when other forage species are scarce (Subramoniam, 2016; Kanny et al., 2022). The plant is also of great importance as a pasture species in Southeast Asia. The Batak Parmalim community from Indonesia uses this plant as a basic source of animal feed (Hanifah et al., 2019). In Vietnam, the grass is also considered a basic source of feed among residents of Nam Dong District, Vietnam, where it is used to feed grazing animals throughout the year (Nguyen et al., 2021). Furthermore, in the Philippines, this grass is traditionally collected from home gardens and

cultivated fields for later use as a feed (Kuni et al., 2015). In Central Java, in turn, *Axonopus compressus* is generally used as green fodder in rabbit farming (Prawirodigdo, 1985). Despite its widespread use, local herders have noticed that the plant is not very palatable to livestock, which prefer other species such as Digitaria eriantha (Giraldo-Cañas, 2013; De Alba and Tapia, 1955).

Axonopus compressus also has traditional medicinal uses. The people living in the Peruvian Amazon use decoctions of its root to treat diarrhoea (Vael, 2015). In Colombia, a 'refreshing' remedy is made from sugarcane juice and a macerate of the plant (Giraldo-Cañas, 2013). Meanwhile, in French Guiana, local healers use the plant to prepare remedies to help treat heart problems. Furthermore, in neighbouring Suriname, the Saramaccan people use *Axonopus compressus* as an ingredient in medicinal herbal baths (DeFilipps et al., 2004). The plant is also used in a similar way on the African continent. The Kweni people of Côte d'Ivoire also prepare medicinal baths with the plant. However, these are primarily intended to treat guinea worm (*Dracunculus medinensis*) infections (Burkill, 1985). In the southern regions of Nigeria, *Axonopus compressus* is used to treat ailments such as the common cold and diabetes (Subramoniam, 2016; Ibeh et al., 2013). The stem sheath, by contrast, is used in medicines for haemorrhoids (Soladoye et al., 2010; Rahman et al., 2014). It is also used in traditional Asian medicine. In Indonesia, an extract made from the fresh leaves is consumed to treat stomach ailments and coughs (Bana et al., 2016). The plant is also used externally as a poultice to treat toothache (Elisetana et al., 2023). In Bangladeshi folk medicine, the plant is used to treat skin problems such as dermatitis, wounds, and eczema (Mollik et al., 2010). Moreover, in traditional Chinese medicine, *Axonopus compressus* is used to treat diabetes (Zheng et al., 2013). The use of this species in traditional medicine has also been noted among the Talaandig people in the Philippines and among local communities in Vietnam. However, in this case, the specific methods of application have not been documented (Cababan et al., 2019; Nguyen et al., 2021).

In addition to its use in pastoralism and medicine, *Axonopus compressus* plays a role in landscaping. It is widely used for lawns and sports turf. Its resistance to trampling and ability to form dense green carpets are valued in urban areas such as Buenos Aires and Rosario, where it is cultivated in gardens and public spaces. In the 1970s, seeds and stolons were obtained for this purpose from naturally occuring communities along the banks of the Río de la Plata (Parodi and Dimitri, 1972). Likewise, in Colombia, the plant is commonly cultivated as for lawns and football pitches (Giraldo-Cañas, 2013). In North America, *Axonopus compressus* is also a well-known lawn and turf plant. In the past, this was particularly the case in the humid areas along the Gulf Coast of the United States (Hitchcock, 1921).

Axonopus compressus also has ritual uses in some cultures. The aforementioned healing baths used by the Saramaccan people of Suriname are also believed to also serve to spiritually cleanse the person being treated (DeFilipps et al., 2004). In Afro-Cuban religious traditions practised among ethnic communities in Cuba, *Axonopus compressus* plays an important role in the Orisha cult. According to tradition, it is associated with Oshun, a deity responsible for healing, fertility, and protection. As a result, the plant is included in the ritual and magical practices of the people living in these regions (Quiros-Moran, 2003).

Scientific perspective: Phytochemical research on *Axonopus compressus* has shown the plant's diverse content of bioactive compounds. It contains significant amounts of flavonoids (1.92 ± 0.13 mg/100g), alkaloids (2.10 ± 0.12 mg/100g), and polyphenols (1.78 ± 0.21 mg/100g), with moderate levels of saponins (1.20 ± 0.10 mg/100g) and tannins (0.71 ± 0.40 mg/100g) (Ibeh et al., 2013). Other studies confirm the presence of cardiac glycosides, terpenoids, and anthraquinones, may also contribute to its reported medicinal properties (Rahman et al., 2014). Among other compounds, the

presence of β-sitosterol, a phytosterol with anti-inflammatory and cholesterol-lowering effects, has been identified.

The high content of flavonoids and polyphenols in *Axonopus compressus* translates into the plant's strong antioxidant properties. Experiments to date show 92% inhibition in both 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging and lipid peroxidation tests at a concentration of 400 µg/ml. This indicates the strong ability of plant extracts to counteract oxidative damage (Ibeh et al., 2013). In addition, the plant exhibits cytotoxic activity, but its possible antitumour effect still requires further investigation (Rahman et al., 2014).

One of the traditional medical uses of *Axonopus compressus* that has been studied so far is its role in the treatment of diabetes. Studies on rats with alloxan-induced diabetes showed a dose-dependent hypoglycaemic effect, with methanol leaf extract at doses of 250, 500, and 1000 mg/kg reducing blood glucose levels by 19.8%-31.5% (Ibeh et al., 2013). A separate study also confirmed that methanol extract, administered orally at the same dose range, causes a significant decrease in blood glucose levels. These experiments therefore support the traditional use of *Axonopus compressus* in the treatment of this condition (Subramoniam, 2016).

Bacopa crenata (P.Beauv.) Hepper

Family:
Plantaginaceae Juss.

Synonyms:
Herpestis crenata P.Beauv., *Bacopa calycina* (Benth.) Engl. ex De Wild.

Vernacular names:
Guinea-Bissau (Fulfulde): depê-faró, djalonga; International (English): water hyssop, brahmi, moneywort; **Kenya** (Digo): Dokwe; **Niger** (Zarma): Bangou mey dorey; **Nigeria** (Nupe): goladji, golaji.

Conservation value:
Least Concern - LC (IUCN, 2025)

Distribution:
The native range of this species extends from western and west-central tropical Africa to Sudan and KwaZulu-Natal, and also includes Madagascar (POWO, 2025).

Habitat:
Bacopa crenata occurs in wetlands, rice fields, the their drainage, ditches, marshes, ponds, lakes,

and rivers, and is often found on wet sand around drying ponds or growing in shallow water. It has been recorded in Gabon at altitudes from 0 to 520 m a.s.l. and in East Africa up to 1600 m a.s.l. (Cook, 2004; Sosef et al., 2016; Diop, 2020).

Invasiveness: –

Ethnobotany:

Cultural and traditional uses: *Bacopa crenata* is traditionally used across its African range. In Nigeria, the Nupe people use the leaves of this plant as an analgesic remedy to treat eye and stomach ailments (Burkill, 1985). Similarly, in Niger, the Zarma people use the whole plant to relieve stomach ailments (Jazy et al., 2017). Furthermore, the Kenyan Digo community uses the juice from crushed leaves to treat children's stomach aches and relieve headaches. As with the Nigerian communities, the plant juice is used to treat eye conditions, in this case serving as a traditional remedy for ophthalmia. In addition, a decoction of the leaves is used to clean the umbilical cord when there are problems with healing after separation (Ketter, 2011). In general, the species is considered to have properties that help treat conjunctivitis, headaches, and wounds in its native regions (Quattrocchi, 2012; Iwu, 2014).

In addition to its medicinal uses, *Bacopa crenata* is also cultivated and sold internationally as an aquarium plant due to its attractive appearance (Kasselmann, 2003).

Scientific perspective: Despite the known traditional uses of this species, *Bacopa crenata* remains under-researched, with limited phytochemical and pharmacological profiling published to date.

Basilicum polystachyon (L.) Moench

Family:
Lamiaceae Martinov

Synonyms:
Lumnitzera polystachyon (L.) J.Jacq. ex Spreng., *Moschosma polystachyon* (L.) Benth., *Ocimum moschatum* Salisb., *Ocimum polystachyon* L., *Perxo polystachyon* (L.) Raf., *Plectranthus parviflorus* R.Br.

Vernacular names:
Benin (Anii): Atchiwilibenan; **Brazil** (Portuguese): alfavaca; **China** (Simplified Chinese): 小冠熏 (xiǎoguànxūn, xiao guan xun); **China** (Traditional Chinese): 小冠薰 (xiǎoguànxūn), 台灣羅勒 (Táiwān luólè, tai wan luo le); **Democratic Republic of Congo** (Wagenia): bosinéâ, masinéâ; **Ghana** (Akan-Asante): nwansinwansi, awansiwansi; **India** (Tamil): canakkirai, canakki-p-puntu, citevippuntu, cittanantakkirai, cittanantam, kaachana, kaashana, karuppakkirai, lolekam, lolekkirai, naukacini, naukacinikkirai, peykkancan, tulakakikakkirai, tulakakikam, Sonakki poondu; **Indonesia** (East Java, Trenggalek): Sangket; **Indonesia** (Indonesian): Sangket, Sangketan, Surawung gunung; **Indonesia** (Java – Javanfese, Sundanese): Surawung gunung, Surawung leaweung, Wanggung langit, Bajém bali, Sangkét(an), Wangon, Wangun; **Indonesia** (Sumatra): Main-main, Sulaséh dulang, Tapua djattén; **International** (Russian): базиликум многорядный (Basilikum mnogoryadnyy); **Madagascar** (Betsimisaraka): Karanjamboay; **Malaysia** (Malay): musk basil, sangket, sangketan, Tapua Jatten; **Nigeria** (Hausa): kimbar rafi; **Nigeria** (Ijo-Izon, Kolokuma): bụ̀rafụ̀rụ̀, dụ̀wẹ́ị̀ fụ̀rụ̀káná; **Nigeria** (Iko): àkùmbà, zàkùmbà, màkùmbà; **Nigeria** (Izon, Oporoma): bị́; **Papua New Guinea** (Korafe-Yegha): Táima da jóka; **Philippines** (Tagalog, Maguindanao, Pangasinan): Bauing, Lodokong, Pansi-Pansi, Loktokong; **Sri Lanka** (Sinhala): කරල්තලා (karal thala); **Vietnam** (Vietnamese): Giar, Saj, es gia, es sa, moc ma; **Zambia** (Chitonga): Mutandamasenya; **Zambia** (mid-Luangwa Valley): Lwena, Tulwena, Katandaimbu.

Conservation value: -

Distribution:

This species is native to tropical and southern Africa, extending through the Indian Ocean region and tropical to subtropical Asia, reaching as far as northern Australia. It has also been introduced to parts of the Pacific, including the northwestern Caroline Islands (POWO, 2025).

Habitat:

Basilicum polystachyon is commonly found as a weed in open, disturbed areas, typically thriving in moist soils. Its preferred habitats include fallow rice fields, stream banks, and swampy grasslands. This species is characteristic of lowland tropical regions, generally occurring at elevations below 600 metres a.s.l. (Fern, 2016).

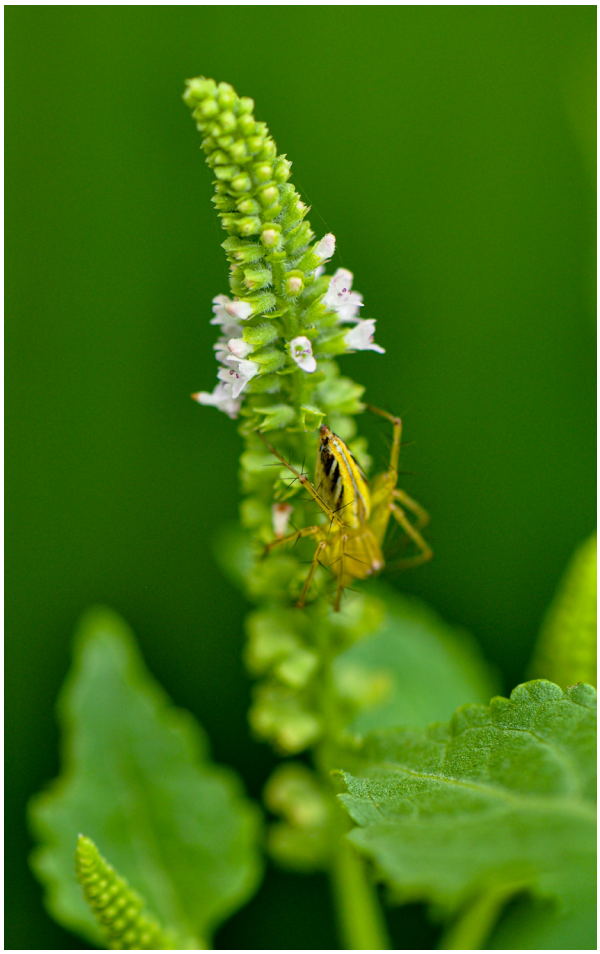
Invasiveness: –

Ethnobotany:

Cultural and traditional uses: In West Africa, *Basilicum polystachyon* is used as a spice to flavour traditional dishes (Abubakar et al., 2023). It is particularly important in Nigerian culinary traditions, where it is used by various ethnic groups such as the Hausa or Ijaw (Izon). These communities use the species primarily as an as a sauce ingredient, and as a seasoning (Burkill, 1985).

However, the main use of *Basilicum polystachyon* is within traditional medicine. It is highly valued for its analgesic and sedative properties. In Indian Siddha medicine, crushed leaves are applied externally to relieve limb pain from sprains. The juice is used as a general painkiller (Quattrocchi, 2012). Similarly, Indonesia (including Java), *Basilicum polystachyon* leaves are used to treat sprains and rheumatic pain (Flora Malesiana, 1974-1978; Abubakar et al., 2023). In Burundi, the fresh leaves of the plant are used to relieve headaches, fever and nightmares. (Ndereyimana, 2021). In Ghana and West Africa, the plant is also used as a remedy for headaches, but the application is quite different. Fresh juice from the plant's leaves is squeezed into children's nostrils to trigger sneezing, which is supposed to relieve the pain (Abbiw, 1990; Abubakar et al., 2023). In southern Africa, the leaves are used to make herbal teas, both for their aroma and their calming effect. The plant is used in the same way among remote Aboriginal communities in northern Australia. In this case, the tea is also valued for its antipyretic and analgesic effects (Williams, 2010). Also noteworthy is the plant's use in the treatment of neurological and nervous system disorders. In Siddha medicine, and in traditional Javanese medicine, *Basilicum polystachyon* is known as a remedy for epilepsy, palpitations, neuralgia, nervous breakdowns, and postpartum depression (Quattrocchi, 2012; Flora Malesiana, 1974-1978; Abubakar et al., 2023). Indigenous communities in Papua New Guinea apply crushed leaves externally to lower

elevated body temperature during infection. Similar uses have been reported in East Java, Indonesia (Agustina et al., 2022). In Kecamatan Jogoroto, Kabupaten Jombang (Indonesia), crushed leaves are mixed with eucalyptus oil and applied to the whole body to relieve fever, migraines and convulsions (Siti Mu'awanah, 2023). *Basilicum polystachyon* is also commonly used in traditional obstetric medicine. In Kenya, when labour is delayed, an infusion of the fruit is consumed to help speed up the birth (van Valkenburg and Bunyapraphatsara, 2001). In Ghana and Nigeria, the fruit is used as a uterine stimulant and as an abortifacient (Burkill, 1985). In Nigeria, the plant is also used as a sedative during pregnancy and postpartum recovery (van Valkenburg and Bunyapraphatsara, 2001). Furthermore, in East Africa, the leaves of *Basilicum polystachyon* are added to decoctions that are supposed to treat menstrual problems and infertility (Makokha et al., 2017). The fresh roots of *Basilicum polystachyon* are also chewed to relieve coughs or cooked with food to relieve flatulence (van Valkenburg and Bunyapraphatsara, 2001). Among the Wange people of Kisangani in the Democratic Republic of the Congo, a preparation made from the leaves of *Basilicum polystachyon* is applied externally to the chest to relieve respiratory complaints (Bokdam and Droogers, 1975). In addition, a decoction of the plant's leaves is traditionally used in East African countries, primarily Kenya, Uganda and Tanzania, to treat conditions such as malaria, flu, and stomach disorders (Makokha et al., 2017). Interestingly, *Basilicum polystachyon* has found a unique use in Brazil. Decoctions prepared from the leaves and flowers of this plant are used there as a medicine to support cholesterol regulation and fight hypertension (Agra et al., 2008). Despite its many uses in folk medicine, reports from Java and northern Australia indicate that internal use of the plant can result in mouth ulcers. Traditional healers therefore recommend using the plant externally only (Cribb and Cribb, 1981; Williams, 2010).



In addition to its medicinal uses, *Basilicum polystachyon* is used as an insect repellent in various cultures. This is particularly important in regions where malaria is prevalent. In countries such as Kenya, Uganda, Tanzania and Ghana, the plant is often burnet indoors to repel mosquitoes, chicken fleas, and even snakes (Makokha et al., 2017; Abubakar et al., 2023). In Kenya, there is also a tradition of burning the herb in pots used to milk cows. This treatment is said to give the milk a pleasant aroma and to keep flies away (van Valkenburg and Bunyapraphatsara, 2001; Makokha et al., 2017). The insect-repellent properties of *Basilicum polystachyon* are also used in livestock husbandry. In Kenya, the plant is also burnt in cattle sheds to protect the animals from parasites (Makokha et al., 2017).

In many places around the world, *Basilicum polystachyon* is also used for ritual purposes. Indian Siddha medicine emphasises the plant's importance in magical rituals to ward off evil spirits (Quattrocchi, 2012). In Ghana, and elsewhere in West Africa, it is sometimes grown near houses because of the belief that its presence provides protection against disease (Abubakar et al., 2023). Among the Wagenia people of the Democratic Republic of the Congo, this species plays an important role in ritual healing and spiritual cleansing. Among other purposes, it is used in reconciliation rituals, where people representing the two conflicting sides rub the leaves on their bodies as a sign of restored harmony. Furthermore, the smoke of the plant is inhaled as a remedy for diseases attributed to witchcraft. A paste made from the plant and white clay is also used for the same purpose. In some communities, a sprig of *Basilicum polystachyon* is also placed under the pillow to ward off bad dreams (Bokdam and Droogers, 1975). *Basilicum polystachyon* also has cultural and ritual significance in Oceania. Among the Korafe-Yegha people of Papua New Guinea, the fragrant leaves of this plant are woven into hip and leg bands during traditional dance ceremonies (Peekel, 1984).

Scientific perspective: Phytochemical research on *Basilicum polystachyon* has confirmed the plant's medicinal potential. It has been shown that methanolic leaf extract contains a diverse range of secondary metabolites, including carbohydrates, saponins, cardiac glycosides, flavonoids, anthraquinones, steroids, triterpenes, tannins, and alkaloids (Abubakar et al., 2023). The chemical analysis of the essential oil derived from the plant led to the identification of such volatile compounds as the dominant methyleugenol (39%), methyl isoeugenol (8%), limonene (7%), 1,8-cineole (5%), β-elemene (5%), β-caryophyllene (5%), β-selinene (4%), citronellal (3.5%), geranyl acetate (2.9%), α-humulene (2.4%), isobornyl acetate (2%), and δ-cadinene (2%). In addition to the characteristic aroma, these compounds are mainly responsible for the plant's antimicrobial, anti-inflammatory, and insecticidal effects. However, the presence of methyleugenol raises concerns about the plant's toxicity. High concentrations of this compound can result in contact dermatitis and potential cytotoxic effects (van Valkenburg and Bunyapraphatsara, 2001), which is in line with the aforementioned concerns of traditional healers.

The plant also has significant antiviral potential. Stachydrine A, isolated from *Basilicum polystachyon*, showed strong activity against dengue virus (DENV), with an IC50 value of 1.4 ± 2 μM in a plaque reduction neutralisation test (PRNT) using Vero cells, derived from African green monkey kidney (Pal, 2024). Another study confirmed a similar antiviral effect, reporting an IC50 value of 1.4 ± 2.1 μM, emphasising its potential as an anti-dengue agent (Dhiman et al., 2022).

The antimicrobial properties of *Basilicum polystachyon* are mainly due to the presence of alkaloids, coumarins, flavonoids, phenols, tannins, triterpenes, and steroids. The plant has been scientifically proven to have a strong antibacterial effect against Gram-positive bacteria. Furthermore, it has been shown that methanol extracts of the plant enhance the effect of conventional antibiotics against multidrug-resistant Gram-negative bacteria. Ethanolic and methanolic extracts also exhibit anti-fungal activity against *Aspergillus niger* (Touani et al., 2014).

In addition to the above properties, *Basilicum polystachyon* also has antioxidant and anti-inflammatory effects, which are attributed to phenolic compounds, including rosmarinic acid and caffeic acid. These compounds play an important role in the alleviation of oxidative stress, and reduction of inflammation (Williams, 2010).

Bergia ammannioides Roxb.

Family:
Elatinaceae Dumort.

Synonyms:
Lechea verticillata Willd., *Bergia peploides* Guill. and Perr.

Vernacular names:
Bangladesh (Bengali): Keshuriya, Lal keshuria; **China** (Mandarin): 田藥曇 (tianfanlü), 密花草 (mi hua cao); **China** (Traditional Chinese): 伯格草 (bo ge cao); **India** (Assamese/Bengali): Dhoolacherra, Dool'eh-churee; **India** (Karnataka - Kannada): Nandi Kallu Soppu; **India** (Rajasthan - Hindi/Rajasthani): Tal Bhungro; **India** (Tamil): Neer-mel-neripoo; **India** (Tamil Nadu - Tamil): Nandukolluppuchedi, Neervaatti; **India** (West Bengal - Bengali): Lal keshuria; **International** (English): Common bergia, Water fire; **International** (Russian): бергия аммаииевидная (bergia ammanievydnaya), Бергия аммаииевая (bergiya ammanievaya); **Israel** (Hebrew): תינמא הייגרב (bergiyah amanit); **Pakistan** (Urdu/Punjabi): Kathali Champa; **Russia/Uzbekistan** (Russian/Uzbek): аммаииясимон бергия (ammaniyasimon bergia); **Vietnam** (Vietnamese): ruộng cày.

Conservation status:
Least Concern - LC (IUCN, 2025)

Distribution:
It is native to a wide range extending from tropical Africa through tropical Asia, southern China, and the islands of Southeast Asia (including Java, the Philippines, and Timor), to Australia (POWO, 2025).

Habitat:
Bergia ammannioides is a hydrophytic herb found in damp or swampy areas, in dried-up pools, and may occur as a weed in rice cultivation, at elevations ranging from 780 to 1,500 m (Ghogue, 2020b). It is also recorded from irrigated fields and the banks of the Euphrates River below the high flood line, at elevations of 20–35 m (Ghazanfar and Edmondson, 2016). In India, it occurs in fallow lands, paddy fields, and grasslands, indicating its presence in seasonally disturbed or cultivated wetland-related habitats (eFlora of India, 2025). In southern Africa, the species inhabits marshy or damp habitats and drying pools (Wild, 1961). In Western Australia, it occurs in dry swamps, along streams, and in creek beds (Western Australian Herbarium, 1998).

Invasiveness: -

Ethnobotany:

Cultural and Traditional Uses: *Bergia ammannioides* is commonly used in its native range to treat wounds and skin diseases. For this purpose, an infusion of the plant is used externally in India (Dangwal et al., 2010; Zereen, 2011; Gritto et al., 2015; Shukla and Singh, 2021). The plant extract itself is also used to treat wounds and infections (Marndi et al., 2020). Similarly, the plant is used in Bangladesh, where it is widely recognised as a traditional medicinal plant used to promote wound healing (Rahman and Kona, 2016). Furthermore, it is used to treat ulcers and blisters in the Kachchh district of Gujarat (Silori et al., 2009). For wound treatment, a paste made from the leaves of *Bergia ammannioides* is applied (Shanmugam et al., 2021). The paste is also used for dental care in the Indian district of Kachchh in the state of Gujarat (Rahman and Kona, 2016). In addition, this plant is also used in India, particularly in the Buxa Tiger Reserve, to treat bone fractures (Gaur, 1999).

Besides the above-mentioned applications, *Bergia ammannioides* is also traditionally used to treat internal ailments. For example, in India, the plant is used to treat menstrual disorders (Chaudhuri, 2007). In addition, in the Rayalaseema region of Andhra Pradesh, it is administered as a remedy for stomach aches (Rao et al., 2006).

Scientific perspective: Phytochemical research on *Bergia ammannioides* indicates a rich variety of bioactive compounds. In a study by Ezzat et al. (2016), the plant extract was fractionated to isolate compound classes. The n-hexane fraction (HxFr; n-hexane fraction) obtained with a non-polar solvent contained important sterols and triterpenes, including lupeol, β-sitosterol, cyclolaudenol, and cycloartenol. When studying the composition of *Bergia ammannioides*, substances such as cyclolaudenol and cycloartenol were identified in the genus *Bergia* for the first time, which illustrates the uniqueness of the plant's chemical composition (Ezzat et al., 2016). Meanwhile, the ethyl acetate fraction (EtFr), extracted with a semi-polar solvent, showed a richness of flavonoids

and polyphenols, such as quercetin, ellagic acid, kaempferol-3-O-α-L-rhamnoside, and quercetin-3-O-α-L-rhamnoside. The above compounds are known for their strong anti-inflammatory and antioxidant properties. In addition, *Bergia ammannioides* contains tannins and terpenoids, which may support its reported wound- and skin-infection-healing properties, directly supporting the plant's traditional uses (Marndi et al., 2020).

Research on the ethanol extract (EtOH) of the plant reported strong wound-healing activity. In particular, HxFr achieved 85.62% wound closure within 10 days in the study's wound-closure assay, comparable to Dermazine cream (95%). The same fraction showed strong anti-inflammatory activity, at 64.5% of the effect of Voltaren gel in the study's anti-inflammatory assay. The EtFr fraction, on the other hand, showed strong free radical scavenging activity, which confirms its properties of reducing oxidative stress (Ezzat et al., 2016). The research published by Ezzat et al. (2016) also confirmed the antibacterial properties of *Bergia ammannioides* extracts. The HxFr fraction showed strong activity against *Staphylococcus aureus* (MIC; minimum inhibitory concentration = 104 µg/ml), supporting its effectiveness in the treatment of bacterial skin infections.

Bergia capensis L.

Family:
Elatinaceae Dumort.IUCN, 2025

Synonyms:
Bergia aquatica Roxb., *Bergia verticillata* Willd., *Elatine verticillata* (Willd.) Wight and Arn.

Vernacular names:
Bangladesh (Bangla): Lal Keshuriya; **China** (Chinese): 大叶田繁缕 (Dà Yè Tián Fán Lü); **India** (Bengali): White Keshuriya; **India** (Gujarati): Jaljambo; **India** (Kachchh, Gujarat): Rapatri; **India** (Tamil): Nandu Kollupu Chedi; **India** (Tamil Nadu; Telugu): Neeru Paavila; **India**: Pola Tsjira; **International** (Spanish): Alfabegueta; **Malaysia** (Malayalam): Pola Tsjira; **South Africa**: White Keshuriya; **Sri Lanka** (Sinhala): ගැටපුරුක් වීල (Gætapuruk wila; Gäta-puruk-wila); **Vietnam** (Vietnamese): ruộng cây vòng.

Conservation value:
Least Concern - LC (IUCN, 2025)

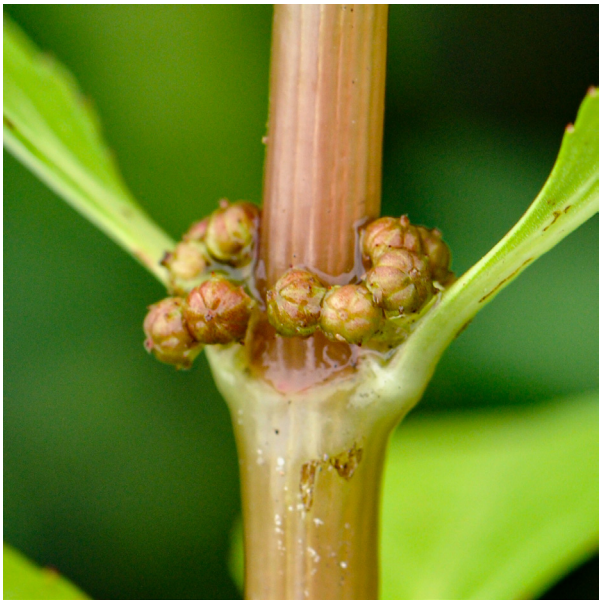
Distribution:
This species is native to parts of Africa (including Namibia and the eastern regions of South Africa), as well as to Iran, the Indian subcontinent, southern China (particularly Guangdong), and western Malesia. It was most likely introduced unintentionally through rice cultivation and trade into several regions outside its native range, including southern Europe (notably Spain and Greece), Central America, Mexico, and various parts of the Caribbean (POWO, 2025).

Habitat:
Bergia capensis is a small, annual hydrophytic herb commonly found in seasonally wet freshwater habitats, such as channels in agricultural fields, rice paddies, ditches, marshes, muddy places, ponds, and small streams. The species shows a high tolerance for temporary flooding and thrives in moist

environments with consistent soil moisture. It typically occurs at altitudes of 700 m a.s.l. The plant is usually associated with disturbed wetlands, including agricultural margins and low-lying grasslands, where soil moisture remains high throughout the growing season (Ghazanfar and Edmondson, 2016; Vélez-Gavilán, 2019; Ghogue, 2020).

Invasiveness: –

Ethnobotany:
Cultural and traditional uses: Despite the occurrence of *Bergia capensis* in Africa, Asia and now on the North and South American continents, current reports on its traditional use mainly come from India. The Malayali people of the Palamalai Hills in the Indian state of Tamil Nadu have found a use for the *Bergia capensis* herb as a topical remedy for wounds and cuts. According to reports, it



has properties that promote healing and prevent infection (Lakshmanan et al., 2018). In Annamalai Nagar, Cuddalore District, rice-field workers use an extract made from the leaves and stems of the plant as a remedy for food poisoning and intestinal worms (Arunesh et al., 2018). In the Gingee Hills, Villupuram District, *Bergia capensis* is still recognised as an important remedy for intestinal parasites (Arulappan et al., 2015).

In the state of Gujarat, north-west of Tamil Nadu, decoctions or pastes are made from the roots and leaves of this plant and used to relieve joint pain and urinary tract ailments (Patel et al., 2010). In this state, this species has also found application in ethnoveterinary medicine. In Porbandar District, crushed leaves mixed with buttermilk are administered orally to animals suffering from food poisoning. This practice is common among Maldhari cattle herders (Jadeja et al., 2006). The plant is also used in the same way in Mehsana District, northern Gujarat, where local shepherds use *Bergia capensis* as a remedy for food poisoning in cattle (Modhvadia, 2009).

Furthermore, there are some reports on the historical use of the plant in Africa. Archaeological evidence from Ghana suggests that its seeds were collected for ceremonial purposes in prehistoric times (Thahimon and Rajasekaran, 2022). However, detailed information about the nature of these rituals remains undocumented.

Scientific perspective: Research into the phytochemical composition of *Bergia capensis* has revealed the presence of alkaloids, anthraquinones, coumarins, flavonoids (including delphinidin, quercetin, cyanidin, and kaempferol), glycosides and glycoflavonoids, iridoids, limonoids, polyphenols, phytosteroids, pregnane, saponins, tannins, and withanolides (Thahimon and Rajasekaran, 2022). This phytochemical profile is consistent with the plant's reported pharmacological properties. Experimental animal studies indicate that ethanolic leaf extracts may lower blood pressure. Furthermore, stem bark extracts have been reported to exhibit significant analgesic effects, while root extracts show anti-inflammatory potential. In addition, the extracts show antiparasitic activity, effectively combating parasitic nematodes. The extracts also have demonstrated in vitro activity against *Staphylococcus aureus* and *Escherichia coli*, supporting reportffed antibacterial use. These effects are not limited to parasites and bacterial infections. In a study by Thahimon and Rajasekaran (2022), the plant was also was also reported to inhibit fungal pathogens such as *Candida albicans* and *Aspergillus niger*. Some extracts have also shown activity against viruses associated with respiratory tract infections. Most importantly, the ability to inhibit HIV-1 reverse transcriptase has also been reported, indicating potential for using the plant for antiviral research in the treatment of HIV (Thahimon and Rajasekaran, 2022).

Bidens pilosa L.

Family:
Asteraceae Bercht. and J.Presl

Synonyms:
Ceratocephalus pilosus (L.) Rich., *Cosmea pilosa* (L.) Spreng., *Kerneria pilosa* (L.) Lowe, *Kerneria tetragona* Moench, *Bidens ododrata* Cav.

Vernacular names:
Angola (Kikongo): kimananganzi, kolokoso; **Angola** (Umbundu): holokoso; **Angola** (Unspecified Dialect): onkholokohò; **Argentina** (Spanish): amor de viejo, amor seco, picón, saetilla, saipiya; **Australia** (English - AU): black fellows, cobbler's pegs; **Bangladesh** (Pangkhua): bidenlosa, sakbal; **Bangladesh** (Bengali): ketul; **Benin** (Cotafon): Djanwounkpi; **Benin** (Saxwè): Djanwounkpi; **Benin** (Ani): Boboyo; **Benin** (Adja): Djankoukouï; **Bolivia** (Spanish - BO): manzanilla del país; **Bolivia** (Quechua): saetilla, sillk'lwa, sanana, vinillo; **Brazil** (Portuguese): amor-seco, aceitilla, agulha-brava, carrapicho, carrapicho de agulha, carrapicho de Duas Pontas, carrapicho-agulha, carrapicho-de-agulha, carrapicho-de-cavalo, carrapicho-de-duas-pontas, carrapicho-picão, coambi, coambu, cuambri, cuambu, erva-picão, espinho-de-agulha, fura-capa, Garyophillata, goambu, guambu, macela de campo, macela-do-campo, Moño de dos Puntas, Mozoquelite, picão, picão-amarelo, picão-das-horas; **Burkina Faso** (Upper Volta /Manding-Dyula): nanguadian; **Burundi** (Kirundi): icanda; **Cameroon** (Babungo): shoctesuc; **Cameroon** (Bamileke): tetse-neck, maleliet; **Cameroon** (Douala): kingné, colé-col; **Cameroon** (Eséka): hasege; **Cameroon** (Ghomala'a): kin gne; **Cameroon** (Mbalmayo): ok padi; **Cameroon** (Unspecified region): tseck neuk; **Chile** (Spanish - CL): asta de cabra, cacho de cabra; **China** (Chinese - Mandarin): 刺針草 (cì zhēn cǎo), 鬼針草 (guǐ zhēn cǎo), 金盞銀盤 (jīn zhǎn yín pán), 南風草 (nán fēng cǎo), 三葉鬼針草 (sān yè guǐ zhēn cǎo), 同治草 (tóng zhì cǎo), 咸豐草 (xián fēng cǎo), 蝦公草 (xiā gōng cǎo), Jin Zhan Yin Pan, Kuei Chen Ts'ao; **Colombia** (Spanish - CO): acahuatillo, aceitilla de flor blanca, alfiler, amapola silvestre, cadillo, cadillo de huerta, cambray menudo, chilca, chipaca, masequia, masiquía, paconca, pacunga, papunga, pecunga, romerillo, romerillo blanco, rosilla del valle; **Colombia** (Cundinamarca): masiquía; **Comoros** (Grande Comore/Comorian): ntsohoyo, sindanou; **Congo** (Kaamba): nkongui nza ngoulou; **Congo** (Efe): kpele, maniti; **Congo** (Katanga): sokontwe; **Congo** (Belgian Congo): luso-lokoto; **Congo** (Ngombe): mondende, Ikongo la ngando; **Congo** (Kirega): banyasa; **Congo** (Lunda): bisonono; **Congo** (Ngwaka): sebanganza, balidwa, sumungenze; **Congo** (Budja): kongo lambala; **Congo** (Lokonda): engunza-e-biboha; **Congo** (Lomongo): ndoko; **Congo** (Mashi/Shi): kashisha; **Congo** (Lega): nyasa; **Congo** (Nyindu): inyabarasanya, nihasha; **Congo** (Kinyarwanda): igishokero, ishisha; **Congo** (Kinande): musonia, ovukuto; **Congo** (Kihunde): muchukwe; **Congo** (Fuliro): kashisha; **Congo** (Kikongo): nsolokoto, kimanangansi; **Congo** (Ngombe - alternate): Ikongo la ngando; **Congo** (Unspecified dialect): ishisha, maniti, boulangou, bemba, nkoucankoué, nkoueankoué, moyindisono, ngafuma, ndabu

zangulu, liele, bulu, ibuya lanpuku, lilya lanpoku, moboso koso, nko koso, gobondima; **Congo** (Akwa): boulangou, bemba; **Congo** (Boko): ndabouza bangoulou; **Congo** (Kikongo): ndabouzangoulou; **Congo** (Koukouya): nkoucankoué; **Congo** (Téké): potambili, odia, oye, kampimpala; **Congo** (Télé): nkoueankoué; **Congo** (Kitembo): nanzwenzwe; **Congo** (Laadi): ndabu zangulu; **Congo** (Ndasa): moyindisono; **Congo** (Mbaamba): ngafuma; **Congo** (Laali): nkonge landjulu; **Congo** (Tié): liele, bulu; **Congo** (Mbôsi): ibyalanpoo, lilya lanpoku; **Congo** (Kôyô): ibuya lanpuku, ndunduba; **Congo** (Bondjo): nongbe; **Congo** (Enyélé): moboso koso, nko koso; **Congo** (Songo): gobondima; **Côte d'Ivoire** (Abure): amonoablanfè; **Côte d'Ivoire** (Akan-Asante): anasipagné, gilingui; **Côte d'Ivoire** (Brong): abissawa, dinenkui; **Côte d'Ivoire** (Baule): alongoa, alongoï, zagaï zagagbé; **Côte d'Ivoire** (Dan): sosolé, solole; **Côte d'Ivoire** (Gagu): diandu, légué, nangua; **Côte d'Ivoire** (Guere): lebason, tabason, tebasson, iréné, iuna, kukwe kwo, zebeyuzébogue, zegbei zegbagwè; **Côte d'Ivoire** (Guere/Wobe): kiradalé; **Côte d'Ivoire** (Kru-Grebo/Nyabo): zagoi ini; **Côte d'Ivoire** (Kweni): gonoretti, pétéoré; **Côte d'Ivoire** (Kulango): kokosa, manamendigo; **Côte d'Ivoire** (Uspecified local): gilingui; **Côte d'Ivoire** (Maninka): passoklo; **Côte d'Ivoire** ('Kru'): diaani, tagiaani; **Cuba** (Spanish): romerillo, romerillo blanco; **Czech Republic** (Czech): dvouzubec chlupatý; **Dominican Republic** (Spanish): alfiler, clavelito del monte, saltillo, yema de huevo; **Ecuador** (Spanish): guichingue, huichinge; **Ethiopia** (Oromifa / Amarigna): chogogitii, chogogit; **Ethiopia** (Amharic): chigogot, chibu, yesitana nuerfe, abare, zagogo, ttchegogot; **Ethiopia** (Oromo / Oromifa - variant): ceekaa, maxxanne; **Ethiopia** (Omotic): gurday; **Fiji** (Fijian): batimadramadra, matakaro, matua kamate, mbatikalawau, mbatimandramandra; **Finland** (Finnish): karvarusokki; **French Polynesia** (Mangarevan - Gambier Islands): tarou, taru; **French Polynesia** (Tahitian): piripiri; **Gabon** (Mpongwè / Orungu): igéngé-bundè; **Gabon** (Galoa): ntombo; **Gabon** (Nkomi): intombo-s'Awiri; **Gabon** (Fang): anyông-éloe; **Gabon** (Mitsogo, Bapunu): nganga, matsi-ma-mangala; **Gabon** (Ivéa/Eviya): mobèndjègè; **Gabon** (Bavili): gimasa-kongi; **Gabon** (Loango): lukayi-lu-mbènzè; **Gabon** (Ngowé): tombu-tsa-Bagisi; **Gabon** (Eshira): boï-bu-tsulu-Barimba; **Gabon** (Béséki): misi-mè-mbwè; **Germany** (German - Germany, Austria): behaarter Zweizahn, zweizahn; **Ghana** (Ashanti): gyinantwi; **Ghana** (Adangme-Krobo): dsetʃi; **Ghana** (Akan-Akyem): kurofidie; **Ghana** (Asante): aseduro, aseduia; **Ghana** (Twi): anansee mpaane, dwirantwi, gyinantwi; **Ghana** (Gbe-Vhe): adzrɔkpi; **Ghana** (Vhe/Pecí): dzani pipi; **Ghana** (Unspecified local): kurofidie; **Ghana** (Gold Coast English): black jack; **Guinea** (Poular): kébbé; **Guinea** (Guerzé): kpakpatiyen; **Haiti** (French): aiguille, z'aiguille, zéguie; **Hawaii** (Hawaiian): kī, kī nehe, kī pipili, nehe; **Hawaii** (English): hairy beggarticks, shepherd's needle; **Honduras** (Spanish): aceitilla, apestosa, rosilla grande; **Hong Kong** (Chinese - Traditional): 鬼針草 (guǐ zhēn cǎo); **Hungary** (Hungarian): farkasfog; **India** (Gujarati): phutium, samara kokadi; **India** (Hindi): kumra, kumur; **India** (Various): arahajad, arakajhar, beggar tick; **Indonesia** (Indonesian): jarongan, rumput juala, subang puteri batek, Ajeran; **International** (Arabic): حسك عربو; **International** (Danish): håret brøndsel; **International** (French): bident hérissé, bident poilu, bidente piloso, herbe aigue, herbe d'aiguille, herbe villebague, piquants noirs, soinette, sornet, sournette, sonmet, herbe d'Aiguille, herbe Z'aiguille, herbe Z'aiguille Blanch Collant, persil bâtard; **International** (Italian): forbicina pelosa; **International** (Portuguese): agulha, amor-de-burro, armore-de-burro, carrapicho-de-agulha, erva-carneiro, fura-capa, macela-do-campo, malpica, murciécalo, pica-pica, picao do campo, picao-preto, pico picho, uva-carneira; **International** (Spanish): acahual, acetillo, amor seco, amorseco, arponcito, asta de cabra, bidente piloso, bidentes, brujilla, cadillo, cacho de cabra, dos dientes, espina de erizo, hierba amarilla, masquia, masiquía, mazote, papuga, papunga chipaca, papaunga chipaca, pegapega, perca, rosilla, sirvulaca; **Israel** (Hebrew): דו-שן ריעש (du-shen sa'ir); **Japan** (Japanese): コセンダングサ (ko-sendangusa); **Kenya** (Ateso): lida; **Kenya** (Ikagusii): ekamogantogia; **Kenya** (Kamba): munzee; **Kenya** (Kikuyu): cege, mûcege, muchege, michegi; **Kenya** (Luo): onyiego, nyanyiek mon, nyanyick-mom; **Kenya** (Marachi): inguyes; **Kenya** (Maragoli): ologohe; **Kenya** (Meru): mumyugunnyugu, rathangi; **Kenya** (Nandi): kipkoleit; **Kenya** (Mbeere): musege; **Korea (South Korea)** (Korean): 흰도깨비바늘 (huin do kkae bi ba neul), 울산도깨비바늘 (ul san do kkae bi ba neul); **Liberia** (Kru-Guere / Krahn): niani; **Liberia** (Mano): zikilli wissi; **Liberia** (Uspecified local): niani; **Malawi** (Chichewa): chisoso, kanzota; **Malaya** (Malay): pau

pau pasir, rumpat juala; **Malaysia** (Malay): coat button, daun roten, kancing, kancing baju, keroten, pau-pau pasir, rumput juala, subang puteri batek; **Mauritius and Rodrigues** (Mauritius – Créole mauricien, Bhojpuri): lavillebague; **Mauritius and Rodrigues** (French): la ville-bague, la ville-bague, lavilbag, tsipolitra; **Mauritius and Rodrigues** (English): cobbler's peg, black-jack; **Mauritius and Rodrigues** (Créole rodriguais): laville bague; **Mexico** (Spanish): saetilla, zeta, acahual, acahuale blanco, aceitilla, aceitillo, amor seco, corrimiento, cruceta, hierba de la culebra, mozote amarillo, mozote blanco, mulito, rosilla, té de milpa; **Mexico** (Chiapas, Hidalgo, Jalisco, Michoacán, Morelos, Oaxaca, Puebla, San Luis Potosí, Tabasco, Tlaxcala, Veracruz, Yucatán): acahual, aceitilla, aceitillo; **Mexico** (Huasteco – San Luis Potosí, Hidalgo, Veracruz): quelem; **Mexico** (Maya): chichik-xul, k'an-mul, matsab-kitam; **Mexico** (Náhuatl): a-cocotli; **Nepal** (Nepali): arthunge, beggar's stick, beggar's ticks, beggarticks, borso tene, hairy beggar ticks, hairy beggar's-ticks, hairy beggar-ticks, hairy beggarticks, hairy bidens, happa myan, jhyapmuja, kalo kuro, katare, kuro, lunge pucha, lwange jhar, mangdhap, nange arthunge, nir, sinke kuro, tinet; **New Zealand** (English): cobblers' pegs, hairy beggarticks, railway daisy, Spanish needle, common black jack; **New Zealand** (Māori): koériki; **Niue** (Niuean): kofetoga, kofetonga; **Nicaragua** (Spanish – NI): cadillo rocero; **Nigeria** (Yoruba): abere-oloko, abere oloko, abẹ́rẹ, abẹ́rẹ olóko, agánran-mọyan, akẹsan, akẹ̀ẹ̀inmásọ, kẹshin, ẹlẹshin-má-sọ, eyinata; **Nigeria** (English – Nigeria): spanish needle, needle grass, black jack; **Panama** (Spanish): arponcito, sirvulada, té de milpa, puinca; **Papua New Guinea** (Rigo, Central Province): matapikwa; **Peru** (Spanish): amor seco, cadillo, tres esquinas, carqueja, chilca, chirihiro, paconca, pacunga, paracunga, pirca, pirco, ppirca, sacha papa, shilcu, sillcan; **Peru** (Quechua): muni, sunila; **Philippines** (Bon): pisan pisau, nguad, puriket; **Philippines** (Bontoc): nguad, puriket; **Philippines** (Filipino – Tagalog): pisau-pisau; **Philippines** (Ibatan): dadayem; **Philippines** (Iloilo / Hoilo): tubacktuback; **Poland** (Polish): uczep owłosiony; **Puerto Rico** (Spanish): manzanilla del país, margarita silvestre; **Rwanda** (Kinyarwanda): inyabarasanya; **Sierra Leone** (Kissi): dada; **Sierra Leone** (Kono): kandanɛ; **Sierra Leone** (Krio): agbɛri-oku, nidul-lif; **Sierra Leone** (Manding-Mandinka): sanyi; **Sierra Leone** (Mende): nana, tombo-maga; **Sierra Leone** (Susu-Dyalonke): saŋyina; **Slovakia** (Slovak): dvojzub; **South Africa** (isiXhosa): umhlabangulo, inongwe (Transkei region), umhalbangubo (Eastern Cape – Grahamstown and Peddie); **South Africa** (isiZulu): uqadolo, imbikicane, imbunya, umhlabangubo, amalenjane, isikhathula, ugamfe, umesisi; **South Africa** (Pedi – Limpopo): mophodisa, mokolonyane; **South Africa** (Venda – Vhavenda): mushidzhi, mushiji; **South Africa** (Maputaland – Zulu): uqadolo; **South Africa** (Northern Sotho): muchize; **South Africa** (Sotho): mokolonyane; **South Africa** (Afrikaans): buschmannspfeil, knapsakkerwel, knapsek?rel, pitch-forks, pitchforks, stick-tights, sweethearts, tantgesieseblommetjie, duiwelskerwel, gewone knapsekerel, kaapsekerel, ouwewenaar, wedevrouens, weduvrouens, gewone knapsekeiel, wevenaar; **South Africa** (English – South Africa): black jack, beggars ticks, spanish needles, beggar sticks; **Spain** (Basque): orratza, eskale akaina; **Spain** (Catalan): bident pilós, gossets peluts, gossos, margarida de marjal, te pelut; **Spain** (Asturian): cadielhu; **Sri Lanka** (Sinhalese): waltekola; **Sweden** (Swedish): nålskära; **Taiwan** (Chinese – Mandarin/Minnan influences): ra-gotupumaita, 刺查某 (cì zhā mǔ), 鬼針草 (guǐ zhēn cǎo), 同治草 (tóng zhì cǎo), 烏杷 (wū bá), 烏階 (wū jiē), 狼把草 (láng bǎ cǎo), 白花婆婆針 (bái huā pó po zhēn), 盲腸草 (máng cháng cǎo), 羞查某仔 (xiū chá mǔ zǎi); **Tanzania** (Swahili): mashona nguo, idasana; **Tanzania** (Nyamwezi): ndasa, nyaweza; **Tanzania** (Haya): akakurura, kakurura, obukurura; **Tanzania** (Sukuma): idasana; **Tanzania** (Nyamwezi/Luguru/Buhkoba – local variants): mbukurura; **Tanzania** (Luguru): nyangudi nyaweza; **Tanzania** (Iraqw): qalmir bo; **Tanzania** (Zaramo): pwimbiji; **Tanzania** (Pare): kimbara; **Tanzania** (Local unspecified): mamiso; **Thailand** (Thai): ปืนนกไส้ (puen nok sai); **Togo** (Krepi): adzrorkpii; **Tonga** (Tongan): fisi'uli; **Uganda** (Acholi): laabika, labika; **Uganda** (Bulamogi): kalala; **Uganda** (Busoga): obukaala; **Uganda** (Lango): ononot, onorol; **Uganda** (Luloro, Lunyoro): nyabaraasana; **Uganda** (Luliya): olukuye; **Uganda** (Luganda): ssere; **Uganda** (Luganda/Kinyankore): ssere; **Uganda** (Lugosa): kalaala; **Uganda** (Ngakarimojong): lomosikin; **Uganda** (Ngai – Apac District): ononot; **Uganda** (Padhola): seere; **Uganda** (Rukonjo): omwisonya, omwisonia, sers; **Uganda** (Runyankole): enyabarashama, murashe, hnyabarashana; **Uganda** (Rutooro): nyabarashana, enyabalashana,

nyabarasana; **Uganda** (Sango Bay): ssere; **Venezuela** (Spanish): cadillo rocero; **Wallis and Futuna** (Wallisian): tae puaka; **Zimbabwe** (English): black jack; **Zimbabwe** (Shona): sine, mhuwuwu, muuwu, nhungunira, muhuwu, guza, nyamaradzo; **Zimbabwe** (Ndebele): umhlabangubo, ucucuza.

Conservation value: –

Distribution:
The native range of this species is the tropical and subtropical Americas, but it is now widespread as a weed in other tropical and warm-temperate regions (POWO, 2025).

Habitat:
Bidens pilosa is a versatile weed occurring in a wide range of environments, including agricultural lands, pastures, roadsides, gardens, disturbed sites, and waste areas. It is common in both ruderal and cultivated habitats, notably in crops like maize, cotton, soybean, and vegetables, as well as in upland rice fields, particularly in Southeast Asia. Natural settings include forest margins, grasslands, wetlands, and stream banks. It grows from sea level up to 3600 m a.s.l., often thriving on alluvial soils (Beentje et al., 2005; Rojas-Sandoval, 2018).

Invasiveness:
Bidens pilosa is a highly invasive weed species native to tropical America. It has spread extensively across tropical and subtropical regions worldwide, including Africa, Asia, Oceania, and the Americas (Rojas-Sandoval, 2018; Kato-Noguchi and Kurniadie, 2024; GISD, 2025e). Its invasive success stems from ecological plasticity, high seed production, effective dispersal mechanisms, and strong competitive abilities. The species thrives in a wide variety of habitats such as disturbed sites, agricultural fields, pastures, roadsides, forest edges, and urban areas (Rojas-Sandoval, 2018; GISD 2025e). It tolerates a broad range of soil types (including sandy and calcareous soils), pH values from 4 to 9, and salinity up to 100 mM NaCl. Additionally, it can withstand drought conditions and survive frost, with root regeneration observed after exposure to temperatures as low as −15 °C (Kato-Noguchi and Kurniadie, 2024). *B. pilosa* reproduces exclusively from seed, with a single plant producing up to 6,000 seeds per year (Rojas-Sandoval, 2018). Its barbed fruits facilitate zoochorous and anthropochorous dispersal by attaching to animals, clothing, and machinery, while wind and water also assist in seed distribution (GISD, 2025e). Once established, *B. pilosa* can form dense, monospecific stands that suppress native flora and crop growth by monopolizing light, water, and nutrients. The plant also exhibits allelopathic properties, releasing phytotoxic substances that inhibit germination and seedling development of neighboring species

(Kato-Noguchi and Kurniadie, 2024). Moreover, it is a known host for various plant pathogens and pests, which contributes to yield reduction in agro-ecosystems (Rojas-Sandoval, 2018). Agriculturally, *B. pilosa* is especially problematic. It is reported as a weed of 31 crops across over 40 countries and is considered a major weed in sugarcane, maize, coffee, tea, cotton, potatoes, vegetables, bananas, beans, tobacco, soybean, and citrus. In Southeast Asia, it is a serious threat to upland rice plantations in countries such as Thailand, Indonesia, Laos, Myanmar, the Philippines, and Vietnam (Rojas-Sandoval, 2018). Climate change projections suggest that the range of *B. pilosa* may expand into warm-temperate regions of Europe, North America, and Asia, increasing its potential invasiveness in new ecosystems (Fan et al., 2025). Due to its aggressive spread and ecological impact, it is recognised as a species of global concern in invasive species management (GISD, 2025e).

Ethnobotany:

Cultural and traditional uses: *Bidens pilosa* is most commonly used as a source of food in African countries, where its leaves are eaten as a vegetable. One such country is Angola, where the leaves are eaten after being boiled (Urso et al., 2016). In Benin, the plant is considered an important leafy vegetable, and its consumption is said to aid digestion (Dansi et al., 2008b). Furthermore, the leaves of this plant are a traditional ingredient in dishes such as romazava, a stew made from zebu meat, tomatoes, onions and leafy vegetables, or *lasopy*, a puréed vegetable soup, in Madagascar (Novy, 1997; Nicolas, 2012). The plant is also consumed in South Africa, where the Xhosa people, like the people of Madagascar, include its leaves and stems in herbal stews. The Venda and Zulu communities also use the aerial parts of *Bidens pilosa* as vegetables. The Zulu people feed the plant to newborns to strengthen their immune systems (Mabogo, 1990; Bhat, 2014; Maroyi, 2017; Constant and Tshisikhawe, 2018). The use of this species as a leaf vegetable has also been recorded in the Shurugwi District of Zimbabwe (Maroyi, 2013; Salinitro et al., 2017). Meanwhile, in West Africa, young leaves and shoots are consumed fresh or dried (Burkill, 1985). *Bidens pilosa* is likewise used in the culinary cultures of North and South America. In Argentina, the rural population consumes the young leaves and flowers of this plant raw in salads or cooked as vegetables (Cantero et al., 2019). In Mexico, the young leafy shoots of this species are prepared for consumption in a similar way to spinach. Moreover, its leaves are used as a substitute for tea (Thomas, 1981; Burkill, 1985).

In traditional medicine, the plant is mainly used to treat digestive and gastrointestinal disorders. In Mauritius, infusions and decoctions of *Bidens pilosa* are traditionally used as stomachic and digestive aids (Daruty, 1886; Lavergne and Véra, 1989). In Burundi, a leaf decoction is used to treat diarrhoea, while in the Democratic Republic of the Congo, salted leaves that have been macerated and mixed with water are taken to relieve abdominal inflammation (De Wildeman, 1935; Ngezahayo et al., 2015). In Équateur Province, young leaves of this species are chewed together with raw palm nut kernels as a remedy for diarrhoea (Konda ku Mbuta et al., 2012). In Côte d'Ivoire, infusions made from *Bidens pilosa* leaves are used to treat colitis and diarrhoea. Furthermore, the young leaves are softened over a fire and mixed with ash from banana peel. They are then administered orally or in the form of an enema as a remedy for the for dysentery in infants (Burkill, 1985). The Kikuyu people in Kenya also prepare infusions and decoctions from the leaves of the plant, which are then administered to people suffering from diarrhoea, worms or other gastrointestinal complaints (Njoroge et al., 2004; Njoroge and Kibunga, 2007). Similarly, the plant is used in Uganda among the Bulamogi community and in South Africa among the Zulu people. The Zulu people use powdered leaves as an ingredient in an enema to treat abdominal complaints (Kirtikar and Basu, 1918; Tabuti et al., 2003; Mathabe et al., 2006). The plant is also used to treat colic. This has been

observed among the Zulus and Ivorians, among others. For this purpose, the roots of the plant are said to be used in addition to the leaves (Kirtikar and Basu, 1918; Kerharo and Bouquet, 1950). In Nigeria, the Yoruba people use the plant to treat intestinal parasites in addition to general gastrointestinal complaints (Ezuruike and Prieto, 2014).

Besides its use in the treatment of gastrointestinal complaints, *Bidens pilosa* is often used in Africa as an adjuvant in the treatment of respiratory diseases. In Mauritius, decoctions of the plant are administered to treat conditions such as asthma and bronchitis (Suroowan and Mahomoodally, 2016). In Burundi, a decoction of the leaves is consumed once a day to support the treatment of pneumonia. Meanwhile, in Équateur Province, Democratic Republic of the Congo, this disease is treated by rubbing a mixture of grated leaves, palm oil and warm ash onto the chest (Ngezahayo et al., 2015; Konda ku Mbuta et al., 2012). Similarly, in Rwanda, *Bidens pilosa* is used in herbal mixtures to make infusions to treat pneumonia (Van Puyvelde et al., 1977). Additionally, the plant is used in some regions to treat and prevent tuberculosis. South African communities consume the leaves to boost their immune systems and fight the disease, while in Uganda, traditional healers use the flowers for the same purpose (Maroyi, 2017; Constant and Tshisikhawe, 2018).

Another property of *Bidens pilosa* commonly used in traditional medicine is anti-inflammatory and analgesic effects. This is applied primarily to the treatment of ailments such as rheumatism and arthritis. For this purpose, the plant has traditionally been used by the Gbaya-Kara people of the Central African Republic, among others (Haxaire, 1979). In the Bas-Congo region of the Democratic Republic of the Congo, decoctions of *Bidens pilosa* in combination with other plant species are used to treat sciatica. In Équateur Province, DRC, a decoction of the plant is used as a cooking liquid for cassava porridge. This dish is said to relieve rheumatic pain (Kibungu Kembelo, 2003; Konda ku Mbuta et al., 2012). In South Africa, the Xhosa people use decoctions of the leaves, taken orally, to relieve symptoms of arthritis. Among the Zulu people, chewing young shoots of the plant is common and is said to alleviate rheumatic complaints. In addition, they apply burnt seeds to cuts, which is said to relieve pain (Bhat, 2014; Kirtikar and Basu, 1918). Among the Kaamba community in Madingou, Republic of the Congo, crushed *Bidens pilosa* leaves are applied topically to relieve intercostal and general muscle pain. Elsewhere in the Republic of the Congo, the freshly ground leaves of the plant are used as a general analgesic (Burkill, 1985; Kimpouni et al., 2018).

As in Africa, the plant is used in traditional medicine in South America, Asia, and Oceania. In Argentina, for example, decoctions of the whole plant are taken orally for digestive problems and inflammation, as is the case with many African societies. Moreover, in Brazil, the plant is considered an anti-dysenteric and vermifuge (Cantero et al., 2019; Lorenzi and Matos, 2021). Among indigenous peoples of the Peruvian Amazon, leaf infusions are used as a general anti-inflammatory and diuretic, and are also known for their beneficial effects on digestive health (Mejía and Rengifo, 2000). In South America, *Bidens pilosa* is primarily known for its role in the treatment of liver diseases. In the Peruvian Amazon, a decoction of the aerial parts is taken three times daily to treat hepatitis (Mejía and Rengifo, 2000; Bussmann and Sharon, 2016). Similar use is recorded in Brazil (Lorenzi and Matos, 2021; Gilbert et al., 2022).

Another condition traditionally treated with *Bidens pilosa* in South America is diabetes. The plant is known as a remedy for this disease in Brazil and Colombia, where root decoctions are mainly used for this purpose (Padilla Portilla, 2009; Lorenzi and Matos, 2021; Gilbert et al., 2022). In Peru, *Bidens pilosa* is often prepared as infusions, combined with other herbs, to support blood sugar regulation (Bussmann and Sharon, 2016).

In parallel with African traditions, local

populations in South America have noted the anti-inflammatory and analgesic properties of *Bidens pilosa*. A decoction of the plant is known as a general anti-inflammatory and analgesic in Argentina, while in Peru they are consumed prophylactically to prevent various chronic pains and general inflammations (Bussmann and Sharon, 2016; Cantero et al., 2019). In the Peruvian Amazon and Brazil, the crushed leaves are applied topically to abscesses, ulcers and fungal skin infections (Chernoviz, 1879; Mejía and Rengifo, 2000; Gilbert et al., 2022). *Bidens pilosa* is also used in South America to treat respiratory diseases. In Brazil, it is traditionally used to treat asthma, bronchitis, pneumonia, and laryngitis (Lorenzi and Matos, 2021; Gilbert et al., 2022). In Peru, expressed leaf sap, mixed with salt, is applied topically to treat conjunctivitis (Mejía and Rengifo, 2000). It is also used in obstetrics, where a decoction of the whole plant is taken to stimulate labour and support maternal well-being postpartum.

Similar uses are reported across Asia. In the Himalayan region, decoctions are traditionally consumed for the treatment of liver disease, bile reflux, indigestion, diarrhoea, dysentery, stomach pain, stomach and duodenal ulcers, urinary tract diseases, respiratory diseases, diabetes, osteoarticular pain, rheumatism. In addition, the plant has been used in this region as a remedy for cardiovascular diseases. It is also used externally to treat wounds, fungal skin infections, wounds and ulcers. In this region, it is also used to support childbirth and improve postpartum recovery. Additionally, it is used to treat kidney and urinary tract diseases. Therefore, it can be said that the plant has a fairly universal application worldwide. The only specific ailments treated with this plant are infusions for prostate problems and hair loss (Kunwar et al., 2021). In the Indochina region, the plant is also traditionally used to treat dental and eye diseases. For dental conditions, dried flower buds are ground, mixed with alcohol, and used as a mouth rinse. Crushed leaves are applied topically to the eyelids to relieve eye pain (Kirtikar and Basu, 1918). A similar application is reported in Oceania, particularly Papua New Guinea, where *Bidens pilosa* is used to treat eye inflammation. Here, fresh leaves are gently heated and applied to the eyes to relieve pain (WHO, 2009).

In addition to its medicinal use in humans, *Bidens pilosa* is used in traditional veterinary medicine. In Guinea, the plant is known as a valuable source of feed. However, the local population points out that it can negatively affect the taste of milk (Burkill, 1985; Carrière, 1994). The plant is mainly used to treat gastrointestinal disorders in livestock. In the Congo–Nile divide region of Burundi, leaf juice is administered by nasal instillation to newborn calves with bloody diarrhoea (Baerts and Lehmann, 1989). In the Katanga region of the Democratic Republic of the Congo, crushed leaves are macerated and administered orally to goats to treat gastrointestinal parasites (Embeya et al., 2011). Furthermore, in Tanzania, decoctions of the leaves, flowers, and stems are administered orally to cattle suffering from diarrhoea (Harjula, 1980). *Bidens pilosa* is also used to treat wounds and eye conditions in animals. In the Ugandan Karamoja region, the Ngakarimojong, Bokora, Matheniko, and

Pian communities use a root paste applied topically to cattle with ocular inflammation and pain. Leaf compresses, in turn, are applied topically to fresh wounds in livestock (Gradé et al., 2009). Kivu region of the DRC, various ethnic groups such as the Mashi, Lega, Nyindu, Banyarwanda, Kinande, Kihunde, and Fuliro combine this plant with other herbs to make a mixture that is said to soothe the effects of snakebite (Balagizi et al., 2005).

Bidens pilosa is also valued by local communities for its other uses. Its flowers are prized by beekeepers. In Africa, bees foraging on the plant produce high-quality honey with a reddish hue (Thomas, 1981). In South America (e.g., Colombia's Nariño region), the species is recognised as a key nectar source for honey production (Padilla Portilla, 2009). The plant is also used by Argentine artisans for dye production. In addition, Argentinian farmers traditionally use the allelopathic properties of *Bidens pilosa* as a natural herbicide to control weeds in cultivated fields (Cantero et al., 2019).

The global reach of *Bidens pilosa* has also left its mark on local beliefs and rituals. In the Ituri Forest, DRC, the Efe people believe that rubbing one's lips with the flowers of this plant before meeting local authorities can improve eloquence and ensure successful communication (Terashima and Ichikawa, 2003). According to Ethiopian beliefs, the plant has protective properties. It is therefore burnt in fumigation rituals. These rituals are said to cure the evil spirit-induced disease maladie du diable (lekefet), which is probably a local term for epilepsy (Kefalew et al., 2015). In Liberia, too, infusions of the plant are traditionally given to infants as a protective tea (Burkill, 1985). The plant also has ritual significance in Venezuela, where indigenous communities traditionally prepare baths with the decoction before leaving their family home. This is supposed to bring them luck and protect them from all evil (Thomas, 1981).

Scientific perspective: Research into the phytochemistry of *Bidens pilosa* has revealed a rich composition of compounds that influence the plant's medicinal properties. Among them are phenolic compounds (tannins, gallic acid), organic acids (oxalic, phosphoric, sulphuric, carbonic, and hydrochloric acid), minerals (potassium salts, calcium, and magnesium), and neutral resin (Thomas, 1981). β-amyrin, friedelin, lupeol, and squalene. It also contains aurone glucosides, luteolin, stigmasterol, and vanillic acid (WHO, 2009). A chemical analysis also determined the plant's nutritional values. According to this analysis, *Bidens pilosa* contains 14.60% protein, 34.46% fibre and 42.18% nitrogen-free extract, which makes it a valuable fodder species, especially for livestock (Padilla Portilla, 2009).

Polyacetylenes, which are found throughout the plant, are associated with its anti-inflammatory, anti-malarial and antimicrobial effects. Flavonoids, in particular chalcones and aurones, have also been shown to have anti-malarial and anti-tumour properties. Terpenoids, including phytol, squalene, β-carotene, lupeol and β-amyrin, in turn, contribute to the antioxidant, anti-inflammatory and anti-tumour properties of *Bidens pilosa*. The steroids campesterol, β-sitosterol and stigmasterol also have anti-inflammatory and immunomodulatory effects. Phenylpropanoids and porphyrins contribute to antioxidant protection and hepatoprotective effects. The plant has anti-inflammatory properties, inhibiting the production of COX-2 and prostaglandin E2, which effectively reduces inflammation. The plant's anti-malarial activity has been attributed to its ability to inhibit *Plasmodium* species, demonstrated in vitro. Meanwhile, the anti-tumour properties are related to the demonstrated cytotoxic effect on tumour cells, as well as anti-angiogenic properties that prevent tumour growth (Gilbert et al., 2022 These data therefore indicate that the pharmacological activity of *Bidens pilosa* is well documented.

Many medicinal properties of this species have been scientifically documented so far. In addition to anti-malarial and antitumour properties, these include anti-malarial, antibacterial, antidiabetic,

hypoglycaemic, antimycotic, anti-inflammatory, antihypertensive, antifungal, anti-ulcer, radioprotective, and anticrustacean properties (WHO, 2009). The antibacterial activity of the plant extracts was particularly noticeable against Gram-positive bacteria. Furthermore, studies conducted in Taiwan emphasised its hepatoprotective properties due to the species' ability to alleviate liver damage caused by hepatotoxins (Lorenzi and Matos, 2021).

The observations of Argentinian farmers regarding the allelopathic properties of the plant have also been scientifically confirmed. Research conducted by Khanh et al. (2009) demonstrated the presence of many secondary metabolites (phenols, polyacetylenes, and triterpenes) in the plant, which strongly influence the growth of neighbouring plant species.

Blumea axillaris (Lam.) DC.

Family:
Asteraceae Bercht. and J.Presl

Synonyms:
Conyza axillaris Lam., *Blumea mollis* (D.Don) Merr., *Blumea perrottetiana* DC., *Blumea wightiana* DC.

Vernacular names:
Australia (English): Tobacco, Spring-bush, Blumea Daisy; **Bangladesh** (local unspecified): Kukur muta; **India** (Bhaderwah Hills, Jammu Province): Nimurdi; **India** (Irula tribe, Tamil Nadu): Kukkura; **India** (Kannada/Tamil): Gabbu soppu, Kaliamman thalai, Basoor, Nimurdi, Pindugu mokka; **India** (Nukha Dora tribe, Andhra Pradesh): Kukka pogaku; **India** (Telangana): Kukka pogaku; **India** (Telugu): Kukka pogaku; **International** (Chinese): 柔毛艾纳香 (Róu máo ài nà xiāng), 红头小仙 (Hóng tóu xiǎo xiān); **Mayotte** (Shimaore): Sari tibaku; **Sri Lanka** (Sinhala): කුකුළ (Kukula), Le waralla; **Zambia** (Bisa, Kunda, Nsenga): Chivurabe.

Conservation value: –

Distribution:
Blumea axillaris is native to tropical and subtropical regions of the Old World, encompassing large parts of South and Southeast Asia, sub-Saharan Africa, and selected areas of Australasia and the western Pacific. Its native range includes countries and regions such as India, China, Thailand, Myanmar, Ethiopia, Kenya, Tanzania, Madagascar, and northern Australia. The species has also been introduced into non-native regions, including west-central Brazil and the island of Mauritius, where it has become established outside its natural distribution (POWO, 2025).

Habitat:
Blumea axillaris is a herbaceous species typically found in swampy sites with impeded drainage, along riverbanks, in seasonally flooded grasslands, in

old cultivated fields, and along roadsides. It often forms dense populations and is recorded at elevations ranging from 1 to 2,000 m, occasionally reaching up to 2,400 m (POWO, 2025). Across its native tropical and subtropical range in Africa and Asia, this species consistently occupies disturbed and semi-natural environments with fluctuating water regimes. In South Asia, such as India, it grows in dry open fallows, grasslands, on hill slopes and along roadsides (Hajra et al., 1995). In southern Africa, including Malawi, Mozambique, and Zimbabwe, the species is associated with wet grasslands, cultivated fields, disturbed margins of arable lands, moist fallow fields, along rivers and streams, as confirmed by regional floristic records (Hyde et al., 2025b; 2025c; 2025d).

Invasiveness: -

Ethnobotany:

Cultural and traditional uses: *Blumea axillaris* is traditionally used in medicine in its natural habitat, which is in South and Southeast Asia, Africa, and Oceania. In India, a cold infusion of the plant is commonly drunk in the Hills of Jammu and Kashmir. This infusion is said to have diuretic and emmenagogue properties, and to help women regulate their menstrual cycles (Kapur, 1996). Conversely, in the Indian state of Telangana, the leaves are used as a remedy for skin diseases, while the aerial parts of the plant are administered to treat diarrhoea (Srinivas Rao, 2016). Similarly, in Tamil Nadu, especially in Coimbatore and the Kumarankundru Hills in Annur, traditional healers use a paste made from the leaves of *Blumea axillaris* to treat skin diseases. They also prepare the leaves for internal use (Jenifer and Lekha, 2019; Ramachandran et al., 2023). Among the local communities living in the Seshachalam Biosphere Reserve in the Eastern Ghats, this plant is used to treat dropsy and throat infections (Reddy et al., 2019). The use of this plant in traditional medicine has been documented among several tribal communities. The Khond tribe in the Paderu division (Visakhapatnam district), the Nukha Dora tribe in Dumbriguda Mandal (Alluri Sitaramraju district), and the Irula tribe in the Palamalai Hills (Coimbatore district) use the paste to cool the skin in hot weather. Furthermore, as in previously reported cases, it is used as a remedy for skin ailments. These tribes also use the sap from the plant's leaves. It is mainly consumed as a remedy for jaundice, but the Irula tribe also uses it to treat diarrhoea (Rao et al., 2022; Padmaja et al., 2023; Priya et al., 2023b). Among the Tharu tribe of Udham Singh Nagar in Uttarakhand, leaf sap is applied to wounds to promote healing, and young twigs of the plant are used as fodder for livestock (Sharma and Lata, 2022).

In Bangladesh, too, *Blumea axillaris* is used by local healers (Kavirajes). As with the Irula tribe, they use the sap extracted from the macerated plant to treat diarrhoea (Das et al., 2012). Meanwhile, on the other side of India, the Lahore people in Pakistan use the whole plant as a fly repellent and as a remedy for haemorrhoids (Zereen, 2011). This is similar to the use of the plant on the island of Mayotte in the Indian Ocean. In this case, *Blumea axillaris* is used to make a special decoction in combination with *Drymaria cordata, Citrus reticulata, Impatiens auricoma*, and *Turraea sericea*. This decoction is used both orally and topically for haemorrhoids. However, local doctors point out that in order for the medicine to work effectively, it is forbidden to eat fish, chillies and citrus fruits during the treatment period (Mchangama and Salaün, 2012). In Sri Lanka, *Blumea axillaris* is used in the local traditional medicine system Deshiya Chikitsa. Practitioners recognise the plant as an effective remedy for the treatment of haemolytic dengue infections. In the Sabaragamuwa Province of Sri Lanka, the plant is also used to alleviate the symptoms of snakebites (Dharmadasa et al., 2015; Siriwardhene et al., 2020). On the African continent, in Kaduna State in Nigeria, *Blumea axillaris* is used to treat malaria. A decoction of boiled leaves is prepared and taken until the symptoms subside

(Dogara et al., 2021).

Apart from its medicinal uses, *Blumea axillaris* has historically been used as a tobacco substitute among Aboriginal groups in Northern Australia. In the absence of commercial or native *Nicotiana* species, its dried leaves were used in pipes (Clarke, 2012). However, some reports suggest that this relationship with tobacco may be more a result of the plant's morphology than its phytochemistry and active substance content (Voogelbreinder, 2022).

Scientific perspective: Phytochemical research on *Blumea axillaris* has identified a number of bioactive compounds with potential medical applications. One of the most important groups of compounds is the essential oils contained in the leaves. Scientific research has confirmed that they have a pronounced antibacterial effect, especially against Gram-positive clinical isolates. Senthilkumar et al. (2009) reported significant inhibition of methicillin-resistant *Staphylococcus aureus* (MRSA) and β-haemolytic *Streptococcus pyogenes*, while Gram-negative bacteria were less susceptible to their effects. In addition, chemical analyses revealed the presence of several bioactive terpenoids and aromatic compounds, including linalool, γ-elemene, copaene, estragole, allo-ocimene, γ-terpinene, and allo-aromadendrene. Scientists suggest that linalool is the main factor contributing to the oil's antimicrobial effectiveness, which is associated with its proven effect against bacteria and fungi. According to the studies conducted, the effect of essential oils indicates their potential use in the treatment of infections resistant to conventional antibiotics.

In addition to its antimicrobial properties, *Blumea axillaris* also exhibits significant insecticidal activity, which confirms its suitability for use as a insect repellent. The bioactive compound (4R,5S)-4-hydroxy-7-angeloyloxycarvatoneacetone, isolated from the plant has a strong larvicidal and ovicidal effect against *Culex quinquefasciatus* and *Anopheles stephensi* mosquitoes, which are responsible for a large proportion of malaria infections in subtropical regions. At a concentration of 2 ppm, the insecticidal activity reached, respectively, 80% and 84% against these mosquito species (Hillary et al., 2023). Histological examination of the larvae showed marked damage to the cells of the epithelium of the midgut, including rupture of the peritrophic membrane and leakage of intestinal contents, indicating a mechanism of action that compromises the integrity of their digestive system. Further molecular analyses showed that exposure to the above-mentioned compound modulated the expression of several functional genes in mosquito larvae. A significant increase in the expression of the gene involved in eye pigmentation and a decrease in the expression of genes related to detoxification and immunity were observed. This suggests that the compound may interfere with resistance mechanisms in malaria vector populations, thus increasing its value in their control strategies. At the same time, a very important observation was that toxicological tests conducted on *Poecilia reticulata* (guppy) showed showed a low-toxicity profile, which confirms the safety of using this substance in an environmental context.

Boerhavia diffusa L.

Family:

Nyctaginaceae Juss.

Synonyms:

Boerhavia diffusa var. *vulgaris* Domin, *Boerhavia repens* var. *diffusa* (L.) Hook.f., *Axia cochinchinensis* Lour., *Boerhavia paniculata* Rich.

Vernacular names:

Angola (Kikongo): ditumbato; **Angola** (Umbundu): (u) lyangulo; **Arab-speaking regions** (Arabic): handakuki, sabaka; **Bénin** (Adja): wassè; **Bénin** (Bariba): gangasikoussou, térédisi, térégasirou, txébissou; **Bénin** (Fon, Goun): gbagbada, gbadjéhwen, handoukpo, katchouanyi; **Bénin** (Gèn): ahozén

ménklo; **Bénin** (Sahouè): hwassia; **Bénin** (Watchi): kpéto; **Bolivia** (Spanish): pegajera, raíz china; **Brazil** (Portuguese): agarra-pinto, amarra-pinto, batata de porco, celidônia, erva-tostão, para-tudo, pega-pinto; **Burkina Faso** (Baoulé): kpopoliko; **Burkina Faso** (Dioula): komengué, kogouagrou; **Burkina Faso** (Shien): blikro; **Burkina Faso** (Tagouana): tifa ogo, tiala noukwo; **Caribbean** (various languages): ipeca; **China, Hong Kong, Macau, Taiwan** (Chinese – Traditional): 黃細心 (huáng xì xīn); **Colombia** (Spanish): rodilla de pollo, tripa de pollo; **Comoros** (Grande Comores): katsi; **Congo** (Kibunda): kitende; **Congo** (Kikongo): dibata-bata, mfundu; **Congo** (Kimbala): mukombelo; **Congo** (Kiloyi): losengo; **Congo** (Kirega): isasa ati; **Congo** (Kisuku): tembi-tembi; **Congo** (Lingala): manioko ya tembe, litambi na nzoku; **Congo** (Mbanza): litshinzi; **Congo** (Ngombe): magbatu; **Congo** (Ngwaka): gbangbuluti, ndemba, balagalan; **Congo** (Nkundo): lokongolokoso; **Côte d'Ivoire** (Abouré): elingami; **Côte d'Ivoire** (Ashanti): matoma élué; **Côte d'Ivoire** (Baoulé): kpopoliko, sémélénia; **Côte d'Ivoire** (Malinké): kok bwè, komakwé, kondouigna; **Côte d'Ivoire** (Shien): bliko; **Cuba** (Spanish): mata pavo, pendejo de perro, tostón; **Czech Republic** (Czech): berhavie rozkladitá; **Democratic Republic of the Congo** (Kinshasa): epuchya; **Dominican Republic** (Spanish): pega-pollo, pega-pollo cimarrón, tostón, yerba de puerco; **French Guiana** (French): ipecacuanha de cayenne; **Guadeloupe** (French): paragon, valériane; **Guatemala** (Spanish): escorian morado, hierba de cabro, moradilla; **Guinea** (Foula): fendala; **Guinea** (Peul): furnêre, kofel, gelodi; **Haiti** (French/Creole): liane manger cochon, manger cochon; **Haiti** (Haitian Creole): liane manger cochon, manger cochon; **India** (Bengali): gandhapurna, punarnava, seveta punarnaba, svetapunarnaba, swetapoorna; **India** (Bihari): goda; **India** (Bombay region/Marathi): ghetuli, khapara, satoodimool; **India** (Cutch region/Gujarati): punarnuwa; **India** (Deccan region): thikri kajhar; **India** (Gujarati): dholi saturdi, moto satodo, vakhakhaparo, vakha khaparo; **India** (Hindi): gadah purna, beshakapore, bish khapra, gadhaparna, gadhapurna, punarnava, sant, santhi, survari, thikri; **India** (Hindi/Sanskrit): bashkhira, punarnava, sant; **India** (Kannada): gonajali, kommegida, sanadika; **India** (Malayalam): talutama, tamilama, tamilana, tavilama, thazhuthama, thazliuthama; **India** (Marathi): पुनर्नवा (punarnava), ghetuli, khapara, rakta vasu, satoodimool, tambadivasu, vasu; **India** (Mundari): kecoara; **India** (Punjabi): it sit; **India** (Sanskrit): bhauma,

punarnava, rakta punarnava, raktakanda, shothaghni, shweta, varshabhu, visha kharparo; **India** (Sindhi): nakbel; **India** (Sinhalese): jan tops, nakbel, petasudupala; **India** (Tamil): kadiyirattam, mukirattai, adaka puttana gida, adakaputtana gida, adathamaamidi, ambati madu, atikamaidi, atikamamidi, attatamamidi, attukamaamidi, balavadaka, balavadike, belavadaka, beshakapore, bhauma, bishkhaparaa, biskhaparia, caranai, caranai ver, carankacacceti, catakakkanni, cattacaranai, cattacataranai, catticaranai, catticattaranai, cenatika, cennakkukka, cennakkurattai, cennatikka, chattaranai, chinawari, cinati, cinatikkurattaikkoti, ciriya mukkurattai, cokkalacceti, culainacani, cuvetapattiram, dholisaturdi, erra galijeru, erragalijeru, gaayi, gaayimore thoppalu, gadaha-purnaa, gadahpurna, gadapurena, gadapurna, gadhaparna, gadhapurna, ganajali, getulee, ghetuli, gonajali, inaikkonam, irattaputpika, irattaputpikacceti, irattaputpikai, irattaputpikam, irattapuḍpikā, kannika, kannikacceti, kannirkkutai, kannirkkutaicceti, kannirnatukkurai, katalikacceti, kaṭhilla, katiyirattam, kattumukkirattai, khaparkhuti, kharaparya, kharkane, khattan, komma, komme beru, kommeberu, kommegida, krishnakhya, krura, laalapuiruni, lalapuiruni, lalpunarnava, lohita, ltcit, mahavarsabhu, mandalpatrika, mantalattiram, maokirattal, mookarutty vayr, mookirathai saranai, motosatodo, mukaratee, mukaratte, mukkaranti, mukkaratai, mukkarattai-kirai, mukkaratti, mukki-rattai, mukkuranti, mukukrattai, mulattinatikam, mūkkiraḍṭai camūlam, mūkkuraḍḍai (civappu), nadu murukana balli, nadumurukana balli, nalipuruni, nava, navyaswara, nerpolaki, nerpolakicceti, netiyontulaci, nila, nilapunarnava, nilavarshabhu, nilini, patarachata, patharchatta, pincam, ppunarnava, pravrishayani, pravrishenya, pukalpukal, pulappakacceti, punamava, punanarva, punarbhava, punarnarva, punarnava, punarnava rakta, punarnava raktha, punarnavaa, punarnavah, punarnavam, punarnavā (rakta), punarva, punarwa, pundera, puneru, punriyaru, punryaru, puranavam, purittiyam, purnava, purnu, putpakam, putpakkurattai, puḍpakam, rakta punarnava, rakta puspā, rakta-punarnavaa, raktakanda, raktapatrika, raktapunarnava, raktapunārnava, raktapushpa, raktapushpika, raktavarshabhu, raktavasu, raktha punarnava, rakthavasu, ranga punarnabha, rettappinappikam, ronga punarnabha, sanaadika, sant, santhi, sarini, satha, sathi, satodimula, sattaranai, saturdi, shanaata, shilatika, shodhani, shonapatra, shophaghni, shothaghni, shovaata, shyma, sinadika, sindika, sonaa jaali, sopfhaghni, sophagni, sophagnni, sothaghni, sothagni, spiderling, spreading hogweed, surkh punarnava, talutama, tamilama, tavilama, tazutama, thanneer kodappan kirai, thazhuthama, thikri, thopparu, ticaimali, ticaimalicceta, tiraiviccata, tiraivikkurattai, tiriviccuta, tirivinkata, tukhm-i-ispast, uruttirani, uruttiranikkoti, vaishakhi, vanjula punarnava, varsabhu, varsabu, varshaabhu, varshabhava, varshabhu, varshaketu, varusapu, varutaketuccam, varṣābhu, vasu, vasuchimuli, vikacata, virocana, visakha, visakhah, vishaghni, vishakarpara, vishakharpara, vosu, vrsciva, vrscivah, vrusir, yerra galijeru, śophaghnī, śothaghnī; **Indonesia** (Javanese, Sundanese, Balinese): ceplukan, daun sangketan, gendola; **International** (English): boerhavia, creeping spiderling, erect boerhavia, fowl's lice, hogweed, horse purslane, kolan, patchouli, patagon, pigweed, red spiderling, spiderling, spreading hogweed, wineflower; **International** (French): boerhavia à fleurs rouges, patagon, valérian, boerhaavie diffuse; **International** (Russian): Бурхавия раскидистая (Burkhaviya raskidistaya); **International** (Spanish): arete, hierba de perro, hierba de puerco, tostón; **Iran** (Persian): denispat, devasapat; **Japan** (Japanese): benikasumi; **Mali** (Bambara): n'doroni, ndoroni; **Martinique** (French): paragon, valériane; **Mexico** (Maya – Chihuahua, Jalisco, Mexico, Sinaloa, Sonora, Yucatán): chalkilxiu, uxim, uxiuam; **Mexico** (Nahuatl): axihuitl, chakilxiu, coanenepili, condesa, sambesarame macho, tianguispepecla morada; **Mexico** (Spanish): arete, golondrina, golondrina morada, mata de pavo, mochi, palo de agua, siempreviva; **Nepal** (Chepang): kharkane, tambrat; **Nepal** (Danuwar): gadapurena; **Nepal** (Magar): putali; **Nepal** (Majhi): lelbadri; **Nepal** (Nepali): aule sag, chuchuriya, laal gaj pumi, laal punamava, punarnava, putali, ratanaulo, saanupaate, tambrat; **Nigeria** (Ekiti): etipe-elila; **Nigeria** (Hausa): babbajibji, sarikinjibji; **Nigeria** (Koma): gogomashu; **Nigeria** (Yoruba): etiponla, olowojeja; **Pakistan** (Kharan region/Balochi): wallakah; **Pakistan** (Nasirabad Balochi): wasao; **Pakistan** (Urdu): bashkhira; **Paraguay** (Spanish): tororati; **Peru** (Spanish): ipecacuana falsa, ipeca falso, pegapinta, solidonia, solidonio; **Philippines** (Tagalog): paanbalibis, paanbalivis; **Puerto Rico** (Spanish): tostón, yerba de perro, yerba de puerco; **Republic of the Congo**: nsolokoto; **Senegal** (Serere): ngubay gelemb, fàmbar, fèmbar; **Senegal** (Wolof): Ōn i gelemb, wom ogelem; **South Africa** (Afrikaans): regop boerhavia, rooikleefbossie; **Sri**

Lanka (Sinhala): පිට සුදු සාරණ (pita sudu sarana), karicharanai, sarana; **Sri Lanka** (Tamil/Sinhala): chattaranai, kancharanai, mukurattai; **Tanzania** (Kagera): kimotoka; **Thailand** (Thai): **ผักขมหิน** (phak khom hin); **Togo**: katson–agni; **Togo** (Akposso): maligba; **Togo** (Ewé): awahassa; **Trinidad and Tobago** (English): hogweed; **West Indies** (unspecified local language): bejuco de purgacion, ipeca, tassole glouteronne velue, valeriane patagonelle.

Conservation value: –

Distribution:

Boerhavia diffusa is widely distributed across the tropical and subtropical regions of the world. It is native to a broad range spanning parts of Africa, Asia, the Americas, and various islands in the Indian and Pacific Oceans. The species occurs naturally from sub-Saharan Africa through the Indian subcontinent and South-East Asia, extending into northern Australia and large areas of Central and South America. It is also native to parts of the Caribbean and southern regions of the United States. In addition to its native range, *B. diffusa* has been introduced to several other tropical areas, including parts of the south-eastern United States, island territories in the Indian Ocean, Angola in Africa, and parts of Central and South America (POWO, 2025).

Habitat:

Boerhavia diffusa is a widely distributed pantropical weed commonly found in open and disturbed habitats ranging from sea level to 2000 m a.s.l. It thrives in diverse soil types, including sandy beaches, salt pans, silty clay alluvium, ferralitic soils, and limestone substrates. The species favours sunny, open areas such as roadsides, fallow lands, agricultural margins, forest clearings, and coastal regions. It is nitrophilous and benefits from nutrient-rich or fertilized soils. Mechanical weeding can inadvertently promote its persistence by splitting the taproot. In Northern Cameroon, it is abundant on well-structured moist soils and ferralitic soils along streams. On islands in the Indian Ocean, such as the Comoros, it thrives in old vegetable fields and is widespread at low and mid-altitudes. In Madagascar and Mauritius, it occurs mainly in dry and wet fallow lands, roadsides, and cultivated plots. It is also found in a variety of natural and anthropogenic habitats in Mayotte, Réunion, and Seychelles (Rojas-Sandoval, 2015b; Spellenberg, 2025; WIKTROP, 2025; WFO, 2025).

Invasiveness: –

Ethnobotany:

Cultural and traditional uses: Unlike its use in medicine, *Boerhavia diffusa* is rarely used as a food source. Nevertheless, in Senegal, the leaves of the plant are used as a typical leafy vegetable. The leaves are cooked and added to sauces or combined with other vegetables to enrich traditional dishes (Gueye and Diouf, 2007).

In terms of medicinal uses, *Boerhavia diffusa* is highly valued across the African continent. Preparations made from the roots of this plant, such as decoctions, infusions and macerations, are widely used for liver and kidney ailments, including jaundice and gallstones (Diallo, 1983; Kpodar et al., 2016; Lautenschläger et al., 2018). The coastal region of Togo, for example, treats liver diseases with a decoction of the rhizome (Kpodar et al., 2016). The Umbundu people of Angola use these decoctions to treat jaundice (Bossard, 1996), while in Côte d'Ivoire, the root juice is used to treat kidney disorders through both internal and external application (Bouquet and Debray, 1974). Infusions of *Boerhavia diffusa* root are also used for gastrointestinal complaints, including diarrhoea, stomach cramps and dysentery (Diallo, 1983). In Congo-Brazzaville, ground leaves mixed with palm oil and lime are used for stomach complaints. They are also applied externally as an ointment to relieve gastritis and indigestion. In the same region, decoctions of the roots are used for diarrhoea and dysentery. They are also recommended for pregnant women whose

pregnancy is at risk (Bouquet, 1969; Adjanohoun et al., 1988). Furthermore, root macerates taken orally or in the form of an enema are commonly used in the province of Équateur in the Democratic Republic of the Congo to combat diarrhoea (Konda ku Mbuta et al., 2012). Meanwhile, the Krob people of Côte d'Ivoire use leaf decoctions or pastes as an adjuvant treatment for cholera (N'guessan et al., 2009a, 2009b).

Infusions and decoctions of *Boerhavia diffusa* leaves are also a traditional remedy commonly used to treat various respiratory diseases such as asthma, bronchitis and pneumonia (Diallo, 1983; Olowokudejo et al., 2008; N'guessan et al., 2009a, 2009b). The Kaamba people of the Republic of the Congo, who live in the Brazzaville region, use preparations made from the root of the plant to treat bronchitis. These preparations are taken orally or administered nasally in the form of snuff (Kimpouni et al., 2018). In Kisangani, on the other hand, the above-ground parts of the plant are pounded into a paste and used as an enema for bronchial diseases (Wome, 1985). The treatment of pneumonia in the province of Équateur is a little more complicated, as it involves massages with *Boerhavia diffusa* leaves mixed with palm oil and hot ashes, together with *Synedrella nodiflora* and *Bidens pilosa* (Konda ku Mbuta et al., 2012).

Boerhavia diffusa is also used for general inflammatory conditions, such as rheumatism and joint pain. Decoctions of the roots and leaf paste are commonly used for this purpose (Diallo, 1983; Lautenschläger et al., 2018). In the Congolese province of Équateur, palm-oil-saturated leaves are massaged into the skin (Konda ku Mbuta et al., 2012). In Côte d'Ivoire, the juice from the root of the plant is used externally to treat rheumatic complaints and sprains (Bouquet and Debray, 1974). Another traditional use of *Boerhavia diffusa* is for the topical treatment of skin diseases and wounds. Among African peoples, compresses made from this plant are often used to help treat burns (Diallo, 1983). In Kisangani, the Democratic Republic of the

Congo, the crushed leaves are often applied directly to open wounds (Wome, 1985). Among the Nkundo community living in this country, the crushed leaves are mixed with palm oil to form a paste that is applied to fractures to accelerate regeneration (Verbeeck, 1948). In the context of dermatological disorders, the Gbaya-Kara people of the Central African Republic use crushed *B. diffusa* roots to treat abscesses. For skin growths and fungal infections, the roots are applied topically after being mixed with water or oil. The same method is used to treat the external symptoms of goitre (Haxaire, 1979). In Togo, the crushed root pulp is mixed with Blighia sapida seeds and then applied topically to treat plantar ailments (Adjanohoun et al., 1986). Skin conditions, such as cracked heels are treated in the Bas-Congo province with multi-herb preparations that usually include the roots of *Boerhavia diffusa*. These are combined with *Smilax anceps*,

Helichrysum mechowianum, and *Eremospatha haullevilleana*, which are then boiled and used in foot baths or applied directly to the affected area (Kibungu Kembelo, 2003). *Boerhavia diffusa* is also used to treat shingles among the Krobou people living in Côte d'Ivoire. For this purpose, they use a paste made from crushed leaves of the plant (N'guessan et al., 2009a, 2009b). Skin diseases are treated by the Nigerian Koma people in a slightly different way. They use terminal buds of *Boerhavia diffusa*, which are administered intranasally or in the form of suppositories to help fight dermatoses (MacDonald and Olorunfemi, 2000).

Preparations made from *Boerhavia diffusa* are also used to treat infectious diseases, such as malaria, yellow fever, and smallpox among the African population. In the treatment of malaria, whole-plant macerates are applied as enemas or leaf decoctions are taken orally (Kasuku et al., 1999; N'guessan et al., 2009a, 2009b; Lautenschläger et al., 2018). In the Uíge province of Angola, yellow fever is treated with leaf-decoction baths (Lautenschläger et al., 2018). A decoction of *Boerhavia diffusa* with the addition of *Blighia sapida* seeds is used as a traditional remedy for smallpox (Diallo, 1983; Kerharo and Bouquet, 1950). In Togo, crushed leaves are mixed with fermented corn flour and consumed as a traditional remedy for tetanus (Adjanohoun et al., 1986). The plant is also used to treat bite-related ailments. The leaves and roots are used as an antidote for snakebites and scorpion stings (Diallo, 1983; Gelfand et al., 1985; Olowokudejo et al., 2008; Kibungu Kembelo, 2003; Lautenschläger et al., 2018). Another medical field in which *Boerhavia diffusa* is used is reproductive health. Preparations made from the leaves and roots of this plant are used in Africa as a means of supporting and stimulating labour. They are also used to regulate menstruation, and treat infertility and postpartum haemorrhage (Diallo, 1983; Bouquet and Debray, 1974; Adjanohoun et al., 1988; Kibungu Kembelo, 2003; Konda ku Mbuta et al., 2012). In the sphere of sexuality and vitality, the roots of *Boerhavia diffusa* are used as a traditional aphrodisiac and stimulant for men in several regions of the Democratic Republic of the Congo, including Manianga, Mayumbe, and Bas-Congo (Nsimundele, 1966-1968; Arkinstall, 1979).

Boerhavia diffusa is also used to treat neurological and developmental disorders in children. For this purpose, enemas prepared from crushed, filtered leaves are administered. This enema is used, among others, by the Aka people and the Monzombo communities to support neurological development in children (Motte, 1980). In Kisangani, the above-ground parts of the plant are combined with Laportea aestuans and administered as enemas to treat delayed motor development (Wome, 1985 Similarly, in Kongo Central (formerly Bas-Congo), leaf enemas are given to children exhibiting a condition locally known as coca, meaning delayed walking ability (Kibungu Kembelo, 2003).

Another traditional medicinal use of the plant is the treatment of eye diseases. In Togo, the underground parts of the plant are first soaked in water, and then used as eye drops to treat conjunctivitis (Adjanohoun et al., 1986). This application is also common among the Gbaya-Kara people of the Central African Republic, who instil the root juice directly into the eyes in cases of cicatricial conjunctivitis (Haxaire, 1979).

Boerhavia diffusa is also known for its traditional use in the treatment of general complaints, including headaches, fever, and fatigue. For example, decoctions of the roots are commonly used to control body-temperature fluctuations and to relieve headaches in Kongo Central (Kibungu Kembelo, 2003). Similarly, in the Comoros, the plant is used as a general painkiller, for example as decoction to relieve pelvic pain during pregnancy (Adjanohoun et al., 1982). In Burundi, decoctions are prepared from the above-ground parts of the plant, and the vapour is inhaled to treat migraines and kwashiorkor, a severe form of protein–energy malnutrition (Adjanohoun et al., 1988; Baerts and Lehmann, 1989).

The uses of *Boerhavia diffusa* also extend to other continents. In the Morelos region of Mexico, this species is used externally to treat ulcers, skin wounds, and erysipelas. An infusion of the leaves is also consumed as a laxative. The roots of the plant are valued as a diuretic, emetic, expectorant, and intestinal tonic. Furthermore, the plant is used locally to treat conditions such as asthma, oedema, anaemia, jaundice, urinary retention, and snakebites, largely consistent with uses documented in Africa (Díaz García et al., 2015). In addition, in Brazil, the root of the plant is often ground and applied topically as a poultice for snakebites or parasitic skin infections such as those caused by the bicho-de-pé, also known as the sand flea (Tunga penetrans) (Lorenzi and Matos, 2021). Traditional Brazilian medicine also uses *Boerhavia diffusa* as a remedy for liver and kidney diseases, including hepatitis, jaundice, gallstones, cystitis, and other urinary tract diseases. It is also known locally as a diuretic, choleretic, and blood pressure-lowering agent (Lorenzi and Matos, 2021).

Across Asia, *Boerhavia diffusa* has been used in traditional medicine for centuries. Known as Purnava, this plant plays an important role in the traditional medical systems of Ayurveda and Unani. According to Ayurveda, the roots of *Boerhavia diffusa* have strong diuretic properties and are also used as a laxative, emetic, and expectorant. Local healers recommend these roots for liver disorders, kidney and gallbladder diseases, and urinary tract ailments (Lassak and McCarthy, 1983; Lorenzi and Matos, 2021). These uses largely mirror those recorded on other continents. Other parts of the plant are also widely used. The leaves are considered an effective remedy for improving appetite. They are also used to treat ophthalmia, and joint pain. Unlike the previous cases, Indian folk medicine also uses the seeds of the plant. They are described as tonic, expectorant, and carminative, and are used for ailments such as lumbago, scabies, muscle pain, scorpion stings, and to speed up labour (Kirtikar and Basu, 1918).

The traditional uses of *Boerhavia diffusa* in India also demonstrate regional differences. In Punjab, the plant is primarily used for treating eye diseases. In Mumbai, it is used for treating oedema caused by sepsis, and in Goa and the West Indies, it is used for treating gonorrhoea. As elsewhere, it features in traditional remedies for snakebites and scorpion stings, typically combined with *Gossypium herbaceum* and *Glycyrrhiza glabra* (Kirtikar and Basu, 1918).

The plant is also used in traditional veterinary medicine. The Ekiti people of Nigeria feed the leaves to poultry to alleviate gastrointestinal ailments, and combat intestinal parasites (Kayode et al., 2009). In the Ugandan county of Bulamogi, an infusion of the aerial parts of *Boerhavia diffusa* is given to cattle (*Bos indicus*) to treat the tick-borne protozoan disease theileriosis (Tabuti et al., 2003).

Because the plant is widely used across continents, it has also become embedded in local cultures. In Burundi, for example, the steam from decoctions prepared from the above-ground parts of the plant is inhaled to ward off evil spirits (Baerts and Lehmann, 1989). Furthermore, in the Sakassou region of Côte d'Ivoire, the plant plays an important role in postnatal cleansing ceremonies. For this purpose, an infusion of *Boerhavia diffusa*, *Octodon setosus* and *Sarcocephalus esculentus* is used, which

is then applied as a lotion to women after giving birth. This mixture is intended not only to cleanse the body, but also to lift taboos and restore ritual purity (Kerharo and Bouquet, 1950). In the Congo, the plant was also used for traditional scarification, a practice involving making incisions in the skin to create scar patterns. Introducing mashed *B. diffusa* into the incisions is said to promote safer, faster healings (Descoings, 1963).

Scientific perspective: Phytochemical research has shown that *Boerhavia diffusa* contains over 150 distinct compounds notably rotenoids, alkaloids (punarnavine), flavonoids (eupalitin, quercetin, and kaempferol), ecdysteroids (β-ecdysone), lignans (liriodendrin and syringaresinol), steroids, terpenoids, and phenolic acids. It has also been observed that the above- and below-ground parts of the plant have markedly different chemical profiles, which is reflected in their distinct traditional uses (Gaur et al., 2022).

It has been confirmed that *Boerhavia diffusa* exhibits strong diuretic and nephroprotective effects. Clinical reports indicate that its extracts can promote diuresis at low doses (10-300 mg/kg) (Diallo, 1983; Lorenzi and Matos, 2021). This diuretic effect is attributed to the presence of punarnavine, a water-soluble alkaloid, as well as potassium salts such as potassium nitrate (Lassak and McCarthy, 1983; Mishra et al., 2014). One of the first studies on punarnavine, conducted at the beginning of the 20th century, showed that intravenous administration of this substance stimulates diuresis and increases blood pressure, while indicating its effect on the renal epithelium and vascular regulation (Chopra et al., 1923). In addition to fluid regulation, *Boerhavia diffusa* also exerts renoprotective effects via antioxidant activity, mitigating oxidative damage and restoring the enzymatic balance in nephrotoxic models, including those induced by cisplatin- and diabetes-related injury (Mishra et al., 2014; Gaur et al., 2022).

A well-documented property of *Boerhavia diffusa* is its hepatoprotective effect. Extracts from the plant have been shown to counteract liver toxicity caused by substances such as alcohol, carbon tetrachloride (CCl_4), thioacetamide and paracetamol, normalising elevated liver enzymes and improving histopathological profiles of liver tissue (Diallo, 1983; Lorenzi and Matos, 2021; Mishra et al., 2014; Gaur et al., 2022). Additionally, this effect is often accompanied by choleretic properties (Diallo, 1983; Lorenzi and Matos, 2021), aligning with traditional uses for liver and gallbladder diseases.

Another confirmed property of the plant extracts is their adaptogenic and immunomodulatory effects. The alkaloid and ethanol fractions it contains, in particular punarnavine, syringaresinol mono-β-D-glucoside and eupalitin-3-O-β-D-galactopyranoside, are able to modulate both innate and adaptive immune responses. In addition, these compounds modulate cytokine balance, regulate T-cell function, and confer anti-stress effects consistent with adaptogenic activity (Mishra et al., 2014; Gaur et al., 2022). In general, these properties may support regulation of immune responses and resilience to everyday stressors. In practice, this may involve faster recovery from fatigue and fewer, or milder, infections.

Furthermore, the rotenoids contained in *Boerhavia diffusa*, such as boeravinones G and H, have been shown to inhibit the breast cancer resistance protein (ABCG2), a transporter associated with multidrug resistance in cancer therapy. Punarnavine has also been reported to inhibit the metastasis of melanoma cells by reducing the levels of pro-inflammatory cytokines and matrix metalloproteinases (MMP-2, MMP-9) as well as vascular endothelial growth factor (VEGF) (Mishra et al., 2014; Gaur et al., 2022). Boeravinones B, G, H, and N show not only anti-tumour activity, but also anti-inflammatory, hepatoprotective, and antiviral effects, notably against hepatitis C virus (Gaur et al., 2022).

In line with its traditional use, experimental studies have confirmed that extracts of *Boerhavia diffusa* reduce oedema, suppress abdominal writhing and modulate pain pathways via opioidergic

mechanisms. This effect is attributed in part to the action of flavonoids including quercetin and kaempferol (Mishra et al., 2014). In addition, boeravinone E has shown spasmolytic effects on intestinal smooth muscle and tracheal tissue, which may help to explain the reported effectiveness of traditional uses of the plant for colic, asthma, and menstrual cramps (Mishra et al., 2014).

Furthermore, *Boerhavia diffusa* has been reported to have antidiabetic potential. Experimental studies report that leaf extracts lower blood-glucose levels and increase insulin secretion. These effects are attributed in part to β-ecdysone, an ecdysteroid that modulates AMPK and FGF21 signalling, critical regulators of glucose and lipid metabolism (Mishra et al., 2014; Gaur et al., 2022).

The plant's documented broad spectrum of antimicrobial and antifungal activity is also relevant to the treatment of wounds, inflammation, and diseases of the gastrointestinal and respiratory tracts. Laboratory studies have proven that plant extracts are effective against numerous bacterial strains, including *Staphylococcus aureus, Streptococcus C, Proteus mirabilis, Escherichia coli, Shigella*, and *Salmonella typhimurium*, as well as dermatophyte fungi such as *Microsporum* species (Diallo, 1983; Mishra et al., 2014; Gaur et al., 2022).

Beyond these, studies have also shown additional pharmacological effects of *Boerhavia diffusa* extracts. Methanol extracts rich in liriodendrin have anticonvulsant, antiarrhythmic, and cardioprotective effects. Furthermore, these extracts have been shown to inhibit the expression of inflammatory mediators, and reduce macrophage viability in tuberculosis-infected cell lines (Gaur et al., 2022).

Boerhavia dominii Meikle and Hewson

Family:
Nyctaginaceae Juss.

Synonyms: –

Vernacular names:
Australia (Pitjantjatjara): puun; **Australia** (Gurindji): janpak; Australia (Wilcannia region, Paakantyi): Winkeroo; **Australia** (English): Tah-Vine, Tarvine; **Australia** (Bilinarra): janbag;

Conservation value: –

Distribution:
Boerhavia dominii is endemic to Australia, locally common in drier regions of northern Western Australia, Northern Territory, South Australia, Queensland, New South Wales, and Victoria (Meikle and Hewson, 2024)

Habitat:
Boerhavia dominii is commonly found in disturbed areas, particularly on agricultural land, where it is considered a weed (Randall, 2007). The species adapts well to such environments, thriving in habitats impacted by human activity.

Invasiveness: -

Ethnobotany:
Cultural and traditional uses: The distribution area of *Boerhavia dominii* is much smaller than that of the above-described *B. diffusa*. This results in a smaller number of applications for this plant. Traditionally, this plant was mainly used as a source of food for the Aboriginal and Torres Strait Islander peoples. Its large, water-rich taproot was a valuable source of carbohydrates when roasted, providing

an important nourishment in times of scarcity and famine (Pearson, 1992; Hodge and McKemey, 2013). According to reports, it was considered very nutritious and tasty due to its sweetish and floury consistency (New South Wales Department of Agriculture, 1899). Among the Paakantyi people of the Wilcannia region of New South Wales, the plant was considered a staple of the bush food diet. As early as 1885, Mary O'Kennedy, a teacher, settler, and amateur botanist, who collected more than 550 plant specimens for Ferdinand von Mueller during her stay at Wonnaminta Station, noted its regular use by Aboriginal groups living along the Darling River (Maroske, 2014). Similar methods of use were observed among the Pitjantjatjara people in the Oak Valley community in the Maralinga lands of South Australia. Nowadays, Indigenous Australians use the plant for food only sporadically (Palmer and Brady, 2021).

Scientific perspective: *Boerhavia dominii* was taxonomically distinguished from the better-studied *Boerhavia diffusa* relatively recently, namely in 1984. As a result, the plant is often not distinguished in the literature, which further contributes to the lack of specific descriptions of its properties. Currently, there are no comprehensive studies on the phytochemistry of this species. The conclusions about its potential use can therefore be drawn only from studies on the closely related *B. diffusa*. It can be assumed that although taxonomically different, these related species may exhibit similar phytochemical profiles.

Caesulia axillaris Roxb.

Family:
Asteraceae Bercht. and J.Presl

Synonyms:
Caesulia lancifolia Sweet, *Melanthera orientalis* Spreng. ex DC., *Melanthera orientalis* Spreng. ex DC.

Vernacular names:
Bangladesh (Bengali): golphuli; **China** (Simplified Chinese): 腋序菊 (Yè xù jú); **India** (Bengali): ote kesam; **India** (Hindi): akshaphula, borasda, ghetia kena, harkuch, nichini; **India** (Marathi): kala maka; **India** (Oriya): jamjuria; **India** (Siddha): nilabhmgaraja; **India** (Telugu): erra gobbi, thella jiluga; **India** (Various languages): gathila, goragantha, maka, mako; **Indonesia** (Malay): kangkoeng kerbaoe; **International** (English): pink node flower; **Malaysia** (Malay): chengkeru, kangkong; **Malaysia** (Penang): chinkro, kangkong kerbau; **Nepal** (Nepali): chicory weed, falebaa, galafule, galphule, kanthamale, phalewa, spittle weed, thukaha, thuk jhar .

Conservation value:
Least Concern - LC (IUCN, 2025)

Distribution:

Caesulia axillaris is native to the Indian subcontinent and parts of Southeast Asia. Its natural range extends from Pakistan eastwards through India and Nepal to Bangladesh and Myanmar (POWO, 2025).

Habitat:

Caesulia axillaris typically grows rooted in shallow water at the edges of reservoirs, but can also be found floating on water. Additionally, it inhabits swamps, wet meadows, the banks of canals and irrigation ditches, and, sometimes, rice fields, where it is not considered a pest (IUCN, 2025).

Invasiveness: -

Ethnobotany:

Cultural and traditional uses: Due to its distribution, *Caesulia axillaris* is a plant of practical importance in South and Southeast Asian countries. In the Eastern Ghats of India, the young leaves of this plant are commonly eaten as food. For this purpose, they are mixed with rice and cooked as a vegetable (Murthy et al., 2003; Misra and Misra, 2013). Historically, the plant was also eaten in Penang, Malaysia, typically raw in salads (Ridley, 1907).

Caesulia axillaris is used for medicinal purposes by various ethnic groups in India. The Kutia Kandha tribe, who live in the Kandhamal district of Odisha, prepare a paste of the plant by grinding it with camphor and mustard oil, and apply it to the chest to relieve cold and cough symptoms. They also administer a mixture of *Caesulia axillaris* inflorescences, black pepper and cow's milk to treat dysentery. Alternatively, they use aqueous extract of the whole plant is used to relieve symptoms of malaria (Panda and Misra, 2011). In contrast, in the Purulia district of West Bengal, a paste made from the plant is applied topically to relieve discomfort from water sores (Dey et al., 2012). The sap of the plant is also applied externally among the Tharu people of Uttarakhand, where it is used to treat cuts and wounds (Sharma and Lata, 2022). In traditional Siddha medicine, *Caesulia axillaris* is considered an effective treatment for various neurological conditions such as epilepsy and paralysis (Saroya, 2017).

The plant has also found application in the traditional medicine of Nepal and Bangladesh. In Nepal, practitioners use plant extract for bacterial and fungal infections to facilitate healing (Shreejana, 2021). The Tharu people of Chitwan, like the Tharu of Uttarakhand, use a paste made from *Caesulia axillaris* to treat wounds, stop bleeding, and promote healing (Müller-Böker, 1993). In Bangladesh, practitioners use this species to promote wound healing, as has been reported in the Rajshahi region. They also administer juice extracted from the root orally as a remedy for kidney stones (Rahman, 2013).

Caesulia axillaris also has local significance for livestock farming. The aforementioned Tharu people in Uttarakhand use the plant as a feed ingredient. It also has an ethnoveterinary application, as it is used

as a medicine to accelerate wound healing in animals, as in humans (Sharma and Lata, 2022).

Another use of the plant is as an insect repellent. In Indian rural households, dried *Caesulia axillaris* leaves are placed in storerooms where legumes are kept to repel their pests. Moreover, an extract of the leaves is used as a pesticide, which is an alternative to chemical sprays (Quattrocchi, 2012).

Scientific perspective: Screening tests of the leaves, stems, and seeds of *Caesulia axillaris* show the presence of flavonoids, tannins, phenols, and steroids in extracts prepared with hexane, chloroform, and methanol. No alkaloids were detected in any of the samples tested, which indicates their absence or negligible concentration in specimens of this species (Khan et al., 2016).

Chemical analyses of the essential oil distilled from the plant's leaves showed the presence of substances such as γ-asarone (63.09%) and limonene (30.85%). The other compounds identified were terpinene-4-ol and 2,4,5-trimethoxybenzaldehyde. A structurally new compound was also identified, isolated for the first time from the plant, namely (E)-2-methoxy-4,5-methylenedioxycinnamyl alcohol (Garg et al., 1993). The essential oil has been shown to have antifungal properties. For example, it inhibited the growth of blue mould in oranges caused by *Penicillium italicum*. In addition, the essential oil of *C. axillaris* exhibited fumigant properties, it reduced the contamination of stored wheat by *Aspergillus flavus* over the tested exposure periods. This indicates the possibility of using the plant as a natural fungicide. Furthermore, the essential oil reduced the infestation of insect pests such as *Sitophilus oryzae* and *Tribolium castaneum* (Khan et al., 2016). Earlier studies, for their part, demonstrated the effectiveness of the essential oil against *Spodoptera litura*, which was primarily attributed to the high γ-asarone content (Kulkarni et al., 1986). These properties may directly confirm the validity of the plant's traditional use as a protective agent for stored grain. Methanol extracts from the leaves, seeds, and stems of the plant also exhibit antimicrobial properties against both fungal and bacterial pathogens. When tested at concentrations of 2% and 4%, these extracts inhibited the growth of Escherichia coli (Khan et al., 2017). Therefore, the antimicrobial properties may, in turn, confirm the legitimacy of using this plant as a means of accelerating wound healing.

In addition to the above characteristics, the aqueous-alkaline extracts from the leaves and stems of *Caesulia axillaris* also exhibit allelopathic potential. These extracts inhibit seed germination and have a selective herbicidal effect on plant species of the genera *Ocimum*, *Ammania* and *Fimbristylis*, as well as on the rice plant (*Oryza sativa*) (Srivastava et al., 1982).

Callitriche palustris var. *oryzetorum* (Petrov) Lansdown

Family:
Plantaginaceae Juss.

Synonym:
Callitriche oryzetorum Petrov

Vernacular names:
International (Chinese): 廣東水馬齒 (guǎngdōng shuǐmǎchǐ); Japan (Japanese): ナンゴクミズハコベ (nangoku mizuha-kobe)

Conservation value: -

Distribution:
Callitriche palustris var. *oryzetorum* is native to temperate and subtropical regions of Asia. Its natural range includes the western Himalayas, south-central and south-eastern China, Taiwan, and southern Japan (Kyushu) (POWO, 2025).

Habitat:
Callitriche palustris var. *oryzetorum* is a perennial aquatic plant typically found in ditches, marshes, and rice fields. It thrives in shallow, slow-moving waters and exhibits a wide altitudinal range, occurring from near sea level up to 3,300 metres a.s.l. This adaptability to diverse aquatic environments makes it a significant component of wetland ecosystems (Lansdown, 2006; Tianlu and Lansdown, 2008).

Invasiveness: -

Ethnobotany:
Neither detailed ethnobotanical studies on the traditional use of the variety *Callitriche palustris* var. *oryzetorum* nor studies on chemical properties have been carried out to date. However, the properties and composition may be similar to those of the species *Callitriche palustris*. For example, an infusion of this species is traditionally used in Jammu and Kashmir to treat ulcers and bladder pain. In Russia, it is used to soothe irritated eyes and as a diuretic for conditions such as dropsy and diseases of the urinary tract. In Tibetan medicine, it is used to treat burns (Gairola et al., 2014; Bolotova, 2015).

Camonea umbellata (L.) A.R.Simões and Staples

Family:
Convolvulaceae Juss.

Synonyms:
Convolvulus flavus Salisb., *Convolvulus umbellatus* L., *Ipomoea polyanthes* Roem. and Schult., *Ipomoea umbellata* (L.) G.Mey., *Merremia umbellata* (L.) Hallier f.

Vernacular names:
American Samoa (Samoan): fue lautetele; **Bangladesh** (Bengali): chatakolmi, dudh lota, goria lata, sapussunda;

Bangladesh (Pankho): demra gach; **Brazil** (Portuguese): batata-de-purga; **China** (Chinese, Simplified): 伞花芹栗藤 (săn huā qín lì téng); **China** (Chinese, Traditional): 繖花菜檮藤 (pú huā cài fēng téng), 罉花菜薘藤 (pú huā cài féng téng); **China** (Li/Qi dialect): zhì yǎ bù; **China** (Mandarin): 伞花菜藟藤 (sănhuā mòluánténg); **Costa Rica** (Spanish): churristate; **Cuba** (local Spanish): aguinaldo amarillo, campanilla amarilla; **Cuba** (Spanish): aguinaldo amarillo, bajuco jaibero, bejuco ahorca colono, jabilla; **Dominican Republic** (Spanish): bejuco de tabaco, campana amarilla; **El Salvador** (Spanish): cuelga-tabaco, jícama cimarrona; **Fiji** (Fijian): sovivi; **Global** (English): umbrella merremia, Belan's vine; **Guatemala** (Spanish): cajete, quilamulillo; **India** (Assam/Nambor region): kolia lata; **India** (Assamese): goria lota; **India** (Hindi/Assamese/various): goria loti, kolavara valli, motia, sapussunda, turnaisa, vawkte-sen-til, vayaravalli, voktesentil; **India** (Malayalam/Kerala): prasarini; **India** (Mizo): vawkṭe-sen-ṭil, vawktesentil; **India** (Tamil/Telugu/Malayalam): catukattutivva, chaata kattuthige, chaatu kuttathivva, jalap, kappa thivva, kappativva, kolavara, kolavarvalli, vaeru malle, verumalle; **India** (multiple regional languages): catukattutivva, chaata kattuthige, chaatu kuttathivva, goria loti, kappa thivva, kappativva, kolavara, kolavarvalli, kolia lota, pandritonde, sapussunda, sithri bodu, taurlaung-chauk-rikang, torlongchok, vaeru malle, verumalle, vowktesentil; **Indonesia** (Ambon): petatas utan; **Indonesia** (Balinese): kantang; **Indonesia** (Bangka): akar biabak; **Indonesia** (Buginese): palaparan, rongo; **Indonesia** (Dayak Banyadu): kalamibit; **Indonesia** (Djambi): akar itang; **Indonesia** (East Kalimantan - Kutai): akar endit, pala parang, rongo, ampas-ampas; **Indonesia** (general): aka belan; **Indonesia** (Indonesian/Javanese/Sundanese): akabulu, akar biabak, akar slemang, areuj gereung, areuj kidang, baji seluang, daun bisul, lawatan kebo, rawatan; **Indonesia** (Java): lawatan kebo, warungan; **Indonesia** (Javanese): lawatan kebo; **Indonesia** (Kangean): rabet saobi sabbian; **Indonesia** (Madura): ojaod kedangan; **Indonesia** (Makassarese): ampas-ampas kètjil; **Indonesia** (Malay/Maluku): daoen bisoel; **Indonesia** (Moluccas): daun bisul (bissol); **Indonesia** (Palembang): akar slemang, baju seluang, akar seluang, rawatan, akabulu; **Indonesia** (Sulawesi - Celebes): uwi-im-pager, katama, timbohu kusu; **Indonesia** (Sumatra - West Coast): akar kalimpanan, akar mantji, ubi-ubi, akar bulu; **Indonesia** (Sundanese): areuj geureung, areuj kidang; **Indonesia** (Toba-Batak): andur nasi; **Indonesia** (West Java - Sundanese): areuj kidang, areuj retet, areuj jeuteum, tatapajan, areuj geureung, areuj bulu, areuy palungpung;

International (English): greater bindweed, hog vine, yellow hogvine, yellow merremia; **International** (French): liane à malingres; **International** (Russian): мерремия зонтичная (merremiya zontichnaya); **International** (Spanish): moradilla martynika, batatilla amarilla, cuajo de hule, cuelga tabaco, tripa de gallina, campanita amarilla, aguinaldo, churistate, aguinaldo amarillo; **Japan** (Japanese): ヒルガオ科 (Hirugao-ka); **Lesser Antilles** (French/English/Creole): fleur patate jaune, liane à berceau, liane à malingres, liane à tonnelle, liane douce jaune, liane-berceau, lyann berceau, lyann beso, lyann dou jon, sweet liane, sweet william, yellow hogvine, yellow morning glory, hog vine; **Malaysia** (Kenyah): aka belan; **Malaysia** (Malay): akar bunga kuning, akar liha patong, akar senduduk belanga, akar ulan, hog vine, kamokamotihan, ulan, ulan betina, ulan tapak pelandok, ulan tapak pelanduk, yellow merremia, akar ulan betina, andur nasi, greater Malayan bindweed, pelandok, ulan tapak; **Malaysia** (Malay, Peninsular): akar bungah kuning, akar ulan tapak pĕlandok, akar lakoon, akar liha patong, akar ulan bitina, andur nasi, ulan tapak pelandok; **Malaysia** (Sabah - Br. North Borneo): akar laren, lankal lankal; **Mali** (Bambara): ulou nin tulu; **Mayotte** (Shimaoré): liane corail; **Mexico** (Spanish): amole de venado, bejuco manzo; **Montserrat** (local English/folk): hog vine; **Myanmar** (Burmese): kya-hin, zizaw; **Nigeria** (Izon/Oporoma): èpírí kòrị; **Palau** (Palauan): kebias; **Panama** (Spanish): batatilla amarilla; **Papua New Guinea** (Northeast): maboka; **Paraguay** (Ayoreo): quiró; **Philippines** (Bisayas): tukod-tukod; **Philippines** (Filipino): malakamote; **Philippines** (Ilocos/Iloko): bangbangau; **Philippines** (Pampanga): malakamote; **Philippines** (Pampanga, Tagalog): kamokamotihan; **Philippines** (Tagalog): kalamitmit, kamokamotihan, malakamote; **Philippines** (Tagalog/Visayan): bangbangau, kalamitmit, kamokamotihan, malakamote; **Philippines** (Tagbanua): kalamintmi, kalamitmit; **Senegal** (Casamance): oulou nin toulou; **Sierra Leone** (Mandinka): soriondibi; **Sierra Leone** (Mende): kpokpo; **Sierra Leone** (Susu): liti; **Sierra Leone** (Temne): a-gbungabo; **Sri Lanka** (Sinhala): කිරි මදු (kiri madu), මහ මදු (maha madu), kiri madhu, maha madu, kiri maduvael, koora; **Taiwan** (Chinese): 毛姬旋花 (máo jī xuán huā); **Thailand** (Thai): chingcho khaao, thao dok baan tuum; **Thailand** (Thai/Udon Thani): jing jor khaow; **Thailand** (northern): chingcho khaao; **Thailand** (peninsular): en; **Thailand** (south-eastern): thao dok baan tuum; **Vietnam** (K'Ho): biap lwoat; **Vietnam** (Vietnamese): bìm bắc bộ, bìm tán, bìm bìm hoa tán.

Conservation value: -

Distribution:

Camonea umbellata is native to tropical and subtropical America, including the Caribbean and the Cayman Islands, as well as to western and west-central tropical Africa. Outside its native range, the species has been introduced to various regions, including the Comoros, Cook Islands, Fiji, Florida (US), Galápagos, Hawaii, Mauritius, New Caledonia, Réunion, Samoa, the Society Islands, and the Western Himalaya (POWO, 2025).

Habitat:

Camonea umbellata thrives in open and disturbed environments such as forest edges, grasslands, roadsides, waterways, and wetland margins, occurring from sea level up to approximately 1,500–1,600 m in elevation This species favours more open situations along the edges of fields, plantations, and water bodies. It also occurs on sandy soils (Arreces-Berazain, 2016). In Sri Lanka, it occurs in thickets, forest edges, grasslands, roadsides, and wastelands, while in Bangladesh it is found near water bodies, ditches, and fallow lands, frequently climbing on trees in dense masses (Biodiversity of Sri Lanka, 2017; Flora of Bangladesh, 2021).

Invasiveness:

It is recognized as an invasive species in Hawaii, Fiji, French Polynesia, New Caledonia, the Galápagos Islands, Cuba, and American Samoa (CABI Digital Library, 2025)

Ethnobotany:

Cultural and traditional uses: *Camonea umbellata* is a plant widely used in the food traditions of various cultures. Many local communities value it primarily as a source of food, despite its medicinal properties. In West Africa, in countries such as Mali, Sierra Leone,

and Nigeria, the leaves of this plant are eaten as a leafy vegetable by the Mandinka, Bambara, Temne, Mende, and Susu communities (Burkill, 1985). The situation is similar in Asia. The leaves of *Camonea umbellata* are collected among the K'Ho people of the Bidoup-Nui Ba National Park in Vietnam, where they are used as an ingredient in daily meals (Huong et al., 2021). In Assam, India, the people living in the Baksa district also prepare cooked young shoots and leaves of the plant, known locally as Goria lota (Baro et al., 2015). On the islands of Maluku and Java in Indonesia, the leaves are also traditionally combined with other vegetables in dishes (van Ooststroom and Hoogland, 1948). In South America, *Camonea umbellata* is mainly used for food in Brazil. For example, this species is valued as a source of food by the communities living in the dune areas of São Luís, Maranhão. It is mainly the root of the plant that is consumed there, which is said to have nutritional and health benefits (Carvalho et al., 2020).

On the African continent, the leaves, seeds, and mucilage of *Camonea umbellata* are used to treat various skin conditions. Similarly, in Asia, *Camonea umbellata* is mainly used as a remedy for dermatological conditions. For this purpose, leaf compresses are prepared to accelerate wound healing and alleviate the effects of burns, ulcers, and various skin problems. The plant is used in this way by the Li ethnic group on Hainan Island in China, as well as in the Indian states of Mizoram, Assam, and Kerala, and in the countries of Bangladesh, Malaysia, Indonesia, and Vietnam. In many cases, the effect of the poultices is enhanced by other plant species such as *Curcuma longa* or *Mikania cordata* (Prosea Foundation, 2001; Zheng and Xing, 2009; Rai and Lalramnghinglova, 2011; Quattrocchi, 2012; mYa, 2021; Elisetana et al., 2023). In the Nyishi community in Arunachal Pradesh, India, the whole plant, including the seeds, is used to treat skin conditions and other external ailments such as fistula (Acharya et al., 2021). In Southeast Asia, decoctions, infusions, and preparations made from the mashed parts of the plant are also used to treat ailments such as cracked heels, swelling, and tumours. They are also used as a general disinfectant for ulcers and infected wounds. Similarly, *Camonea umbellata* is used in South America. In the Bolívar region of Colombia, the leaves of the plant are crushed and applied topically as an antibacterial, antifungal and anti-inflammatory agent (Olatunji et al., 2021). There are also reports from this region about the use of compresses made from the leaves of the plant on burns and wounds (Ganjir et al., 2013).

The use of *Camonea umbellata* in the treatment of neurological conditions such as epilepsy, convulsions, and spasms is common on both the African and Asian continents. For example, the Izon people (Oporoma) in Nigeria use powdered leaves of this species as a snuff to treat the symptoms of epilepsy (Burkill, 1985). Powdered leaves, as well as preparations from whole plants, are also consumed for this

type of ailment in Bangladesh (Nahar et al., 2020). In addition to treating these ailments, the leaves are also used as a painkiller for general and back pain, which has been confirmed in Assam, India, among other places (Baro et al., 2015; Yadav et al., 2019).

Further conditions that are traditionally treated with this species include gastrointestinal and urinary disorders. This is because in Bangladesh,

Indochina, and the Philippines, the roots and latex of *Camonea umbellata* are considered to have laxative and diuretic properties (Prosea Foundation, 2001; Quattrocchi, 2012; Nahar et al., 2020). Similar traditional uses of the plant are also found in the Americas. In Cuba, *C. umbellata* is known as an effective remedy for stomach and abdominal pain, especially in the rural areas near Santiago de Cuba (Candó-González et al., 2015). On the Caribbean island of Montserrat, local healers use the roots of the plant to prepare infusions used to treat jaundice (Brussell, 2004).

Additionally, the plant is used to treat snakebites. In Sri Lanka, the effects of snakebites are alleviated with a paste made from crushed leaves (Dharmadasa et al., 2015). Meanwhile, in Bangladesh, a paste made from the leaves of *Camonea umbellata* and the seeds of *Lens culinaris* is traditionally used to stimulate lactation in mothers (Khan et al., 2015).

In addition to culinary and medicinal uses, *Camonea umbellata* also has economic applications. In coastal Ghana, the plant is known as a natural binder that stabilises sandy soils (Burkill, 1985). In the Thai province of Udon Thani, the plant is valued both as a forage crop and as an ornamental species (Saensouk et al., 2025), and in the Americas, it is recognised as a melliferous plant (Schmeda-Hirschmann, 1998; Candó-González et al., 2020).

Scientific perspective: Phytochemical research on *Camonea umbellata* has shown the presence of substances such as quercitrin (7.89 mg/g), 3,4-dicaffeoylquinic acid (4.91 mg/g), 3,5-dicaffeoylquinic acid (4.29 mg/g), and 4,5-dicaffeoylquinic acid (2.66 mg/g) (Lee et al., 2023). In addition, the quantitative analysis showed a phenol content of 57.1 mg GAE/g, flavonoids of 65.12 mg QE/g, and tannins of 57.1 mg GAE/g (Nahar et al., 2020). The presence of alkaloids, caffeic acid, esculin, flavonoids, glycosides, gums, luteolin, N-p-cis-coumaroyltyramine, papaverine, quercetin, reducing sugars, rosmarinic acid, steroids, tannins, and xanthoproteins has also been confirmed (Olatunji et al., 2021). The seeds of the species have been proven to contain mucilage, resins, and fatty acids, which exhibit diuretic, laxative, and healing properties for skin conditions (Burkill, 1985). Furthermore, *Camonea umbellata* extracts demonstrated high antioxidant activity. They were able to neutralise 85.2% of the free radicals in the DPPH (2,2-diphenyl-1-picrylhydrazyl) test, with an IC_{50} of 815.2 µg/mL. Similarly, in the ABTS ((2,2′-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid)) test, the extracts showed 75.5% radical-scavenging activity, with an IC_{50} of 1226.2 µg/mL (Lee et al., 2023). Water-based extracts showed better performance in the FRAP (ferric reducing antioxidant power) test, surpassing the activity of vitamin C (Ganjir et al., 2013). Further studies demonstrated the anti-inflammatory effect of extracts from *Camonea umbellata*, which is related to the high quercetin content (Lee et al., 2023). It has also been shown that *Camonea umbellata* has properties that significantly reduce pain reactions. After oral administration of 500 mg/kg of crude ethanol extract from the plant stem to Swiss albino mice, the hot-plate test showed prolonged latency times comparable to morphine. In the case of analyses of anthelmintic activity, an extract with a concentration of 100 mg/mL induced paralysis and death of *Haemonchus contortus* parasites in 7.65 minutes and 16.43 minutes, respectively. This efficacy can be compared to that of common antiparasitic drugs such as albendazole (Nahar et al., 2020).

Canna glauca L.

Family:
Cannaceae Juss.

Synonyms:
Canna longifolia Bouché, *Canna pedicellata* C.Presl, *Canna stenantha* Nob.Tanaka

Vernacular names:

Argentina (Spanish): achera, achira, achira amarilla, achira blanca, achira de la india, caña de la india, maraca amarilla, maraca amarillo, maraca boba, maraca bola, maraca de pantano, mberig, mberi-saiyú, pariri; **Argentina** (Comechingones region): achira; **Argentina** (Moqoit/Chaco region): pe'lák; **Argentina** (Maka): chelak; **Argentina** (Toba-pilagá): jolelak; **Bangladesh** (Bengali): holud kola-bati; **Bolivia** (Ayoreo): bacaó; **Bolivia** (Spanish): caña de la india; **Brazil** (Bahia): coquilho, caeté imbirí, albará, imbirí, maracá, murú; **Brazil** (Kaingang): p'e'leac; **Brazil** (Marajó): coquilho; **Brazil** (Portuguese): albará, bananeirinha, cana-do-brejo, cana-do-brejo-amarela, coquilho, erva-das-feridas, erva dos feridos, imbiri, meeru; **Brazil** (Portuguese/Guarani region): piriquiti, mbery sa'yu, manacá; **Brazil** (Tupi): tupãypy; **Brazil** (unspecified): imbiri, albará; **China** (Simplified Chinese): 粉美人蕉 (fěn měi rén jiāo); **China** (Traditional Chinese): 粉美人蕉 (fěn měi rén jiāo); **Colombia** (Spanish): bandera amarilla, bandera de uribe, coquilho; **Ecuador** (Spanish): platanillo; **France** (French): balisier jaune; **India** (English): indian shot; **India** (Sinhala): rata-but-saranā; **Indonesia** (Indonesian): kana kuning; **International** (Dutch): blaauwachtig bloemriet; **International** (English): aquatic canna, canna angustifolia, indian shot, the glaucous indian reed, water canna, wild plantain, yellow-flowered glaucous canna; **International** (French): le balisier glauque; **International** (German): achira, das eisengraue blumenrohr; **International** (Mandarin): 粉美人蕉 (fěn měirénjiāo); **International** (Russian): канна сизая (kanna sizaya); **International** (Spanish): caña garza, coyol, patujú, patujú de bajio, patujú de pampa, tarope; **Mayotte** (Shibushi): sari tamotamo; **Mexico** (Campeche): platanillo; **Mexico** (Chinantec/Oaxaca region): mang mu; **Mexico** (Quintana Roo): platanillo; **Mexico** (Yucatán): platanillo; **Paraguay** (Ayoreo): bacaó; **Paraguay** (Guarani): lateni; **Paraguay** (Spanish): caña de la india; **Peru** (Quechua): muru; **Peru** (Spanish): achira; **Venezuela** (Spanish): achira.

Conservation value: -

Distribution:

Canna glauca is native to the south-eastern United States (South Carolina, Florida, Louisiana, Texas) and to a wide range of tropical and subtropical regions of the Americas, including parts of Mexico, Central America, the Caribbean, and South America (e.g., Brazil, Argentina, Colombia, and Peru). Outside its native range, it has been introduced (into) to several Asian countries, including Java (Indonesia), the Philippines, Sri Lanka, Thailand, and Vietnam (POWO, 2025).

Habitat:

Canna glauca is a helophytic perennial species commonly found in wetlands including marshes, swamps, shallow ponds, and ditches, as well as along slow-moving streams. It grows in saturated or waterlogged soils at low elevations, generally from sea level up to about 100 m a.s.l. The species prefers full sunlight and is intolerant of shade. It tolerates a

variety of soil types, including clay, loam, and sandy soils, as long as moisture is consistently available (Flora of North America Editorial Committee, 2000; NParks, 2025).

Invasiveness: -

Ethnobotany:

Cultural and traditional uses: Historically, the South American *Canna glauca* played a role as a source of Tous-les-mois starch, although the more productive Canna edulis was much more commonly used for this purpose (Birdwood, 1862). Today, the plant's rhizomes are still used traditionally for food in Brazil, especially in lowland regions (Kermath et al., 2018). It has been formally recognised as a food plant in the classification of unconventional edible plants Plantas Alimentícias Não Convencionais (PANC) (Kinupp, 2007).

Likewise, in Argentina, among the Gran Chaco communities such as the Lengua-Maskoy, Maká, Ayoreo, and Pilagá, the rhizomes of *Canna glauca* are traditionally used as wild food (Scarpa, 2009). This is also the case in the Caribbean, especially in the Antilles, where the culinary use of *Canna glauca* roots is similar to that in continental South America (Kermath et al., 2018). However, in Ecuador, especially in coastal regions, greater culinary attention is paid to the broad, robust leaves of the plant, which are commonly used to wrap tamales and cheeses. They are also used as containers in the cooking process, which, in addition to their practical function, contribute to the characteristic taste of the dishes (de la Torre et al., 2008).

In Brazilian folk medicine, the root and rhizome of *Canna glauca* have been valued for centuries for their diuretic effect. A traditional diuretic treatment for urinary tract problems involved brewing 8 grams of the root in about 180 ml of water to stimulate urination (Chernoviz, 1879, Le Cointe, 1947). In addition to the above-mentioned applications, the plant was also used to treat rheumatic and musculoskeletal disorders in the past. In these cases, decoctions made from the fresh, aboveground parts of the plant were added to warm baths. Healing baths with this plant were a popular method of relieving the pain and stiffness associated with rheumatism and joint diseases among the 19th-century Brazilian population (Martius, 1843; Chernoviz, 1879).

Historically, the leaves of the plant were also used in the region to treat dermatological conditions, including ulcers, burns, and blisters. For this purpose, the fresh leaves of *Canna glauca* were applied directly to the affected areas of the skin. The crushed herb was also used to wash infected sores (Martius, 1843; Chernoviz, 1879; Le Cointe, 1947). In the 19th-century *Materia medica*, it was also noted that the powdered roots of the plant were used in the region for oral hygiene, while the sap of the plant was used to treat mercury poisoning. Furthermore, the sap of the ripe fruit of the plant was said to be used to treat ear pain (Martius, 1843).

Modern reports on the traditional use of *Canna glauca* come from neighbouring Argentina, where it is still used by the local population in a similar way to the historical Brazilian records. The plant's rhizomes are still commonly used there for their diuretic, diaphoretic, and anti-inflammatory effects. In several provinces, including Buenos Aires, Chaco, Córdoba Sur, Entre Ríos, Formosa, Jujuy, Misiones, and Santa Fe, the rhizomes, roots, and leaves are used in anti-rheumatic treatments and medicinal foot baths (*pediluvium*). Moreover, the seeds are still used as a remedy for earache (Barboza et al., 2009).

Canna glauca is also a species widely known and valued for its aesthetic and ornamental qualities. Owing to its eye-catching flowers and numerous cultivated forms, the plant can be found in garden collections worldwide. In Brazil, Argentina, and Colombia, the species is cultivated in gardens and public spaces, often as horticultural hybrids bearing large red or yellow flowers. Traditionally, *Canna glauca* was a species used in agroforestry systems

in southern Brazil (Santa Catarina). These systems included rotational gardens (*roças*) established along trails and near forest edges. This species was cultivated alongside maize and beans, being classified by the Guaraní as an important food plant (Pereira et al., 2016). Among the Ayoreo people of Paraguay and Bolivia, *Canna glauca* is known as an important nectar source for bees (Schmeda-Hirschmann, 1998).

Scientific perspective: Interestingly, no thorough phytochemical research has been conducted on *Canna glauca*, unlike other species of the genus, such as *Canna indica*.

Caperonia castaneifolia (L.) A.St.-Hil.

Family:
Euphorbiaceae Juss.

Synonyms:
Argythamnia castaneifolia (L.) Kuntze, *Croton castaneifolius* L., *Ditaxis castaneifolia* (L.) Baill., *Meterana castaneifolia* (L.) Raf., *Tournesol castaneifolia* (L.) M.Gómez, *Caperonia angusta* S.F.Blake, *Caperonia paludosa* Klotzsch

Vernacular names:
Brazil (Portuguese): castanheiro-do-brejo, erva de bicho branca; **Dominican Republic** (Spanish): escoba dulce; **Guadeloupe** (French): ortie grosse, mâle coq d'Inde; **International** (English): birdeye, chestnut-leaf false croton, chestnut-leaved croton, Mexican weed; **International** (Spanish): caperonia; **Martinique** (French): ortie-savane; **Peru** (Quechua): yacu ishanga; **Puerto Rico** (Spanish): sacatrapo.

Conservation value: -

Distribution:
Caperonia castaneifolia is native to tropical America, with its natural range extending from Mexico through Central America into South America, including countries such as Argentina (north-east and north-west), Belize, Bolivia, Brazil (northern and west-central regions), Colombia, Costa Rica, Cuba, the Dominican Republic, Ecuador, Guyana, Haiti, Honduras, Jamaica, Nicaragua, Panama, Paraguay, Venezuela, and the Windward Islands. Outside its native range, the species has been introduced to Florida in the United States (POWO, 2025).

Habitat:
Caperonia castaneifolia typically inhabits shallow, seasonally wet environments within tropical lowland regions. It is commonly found along the

margins and banks of ditches, canals, marshy areas, and lakes, particularly in shallow water or saturated soils. The species occurs from 0–30 m a.s.l. (Gillespie, 2016). Additionally, herbarium records indicate its presence along roadsides (Smithsonian Institution, 2025), as well as in Florida, where it has been documented in shallow water near marsh margins.

Invasiveness: -

Ethnobotany:

Cultural and traditional uses: *Caperonia castaneifolia* is known in Guyana as 'wild green tea'. The vernacular name reflects its use as a herbal tea. To prepare the tea, a decoction of the aerial parts is prepared by boiling. After cooling, the decoction is consumed, which is said to purify the blood and to treat conditions such as dysentery (Austin and Bourne, 1992). According to available information, the plant is also used in the San Martín region of Peru to relieve swelling and treat cancer. Unfortunately, the exact methods of preparation and application of remedies derived from this plant are not documented in the cited sources (Delgado Súmar, 2018–2019).

Scientific perspective: To date, few studies have investigated the phytochemistry of *Caperonia castaneifolia*. One of the few studies has shown significant acaricidal (tick-killing) activity for this plant. In larval immersion tests, a 40% ethanol–water (v/v) extract showed 100% efficacy against Asian blue tick larvae (*Rhipicephalus microplus*). This result places *C. castaneifolia* among 18 plant species reporting more than 95% efficacy against tick larvae when using solutions of similar concentration. These results indicate the high potential of the plant as a source of natural acaricides. Unfortunately, further studies on the use of *Caperonia castaneifolia* extracts against adult ticks were not conducted due to the limited availability of raw material for testing (Santos et al., 2013).

Cardamine hirsuta L.

Family:
Brassicaceae Burnett

Synonyms:
Crucifera cardamine E.H.L.Krause, *Ghinia hirsuta* (L.) Bubani

Vernacular names:
Albania (Albanian): kardamina qimeashpër, kardamine; **Argentina** (Spanish): Berro cimarrón; **Austria** (German): Behaartes Schaumkraut, Gartenschaumkraut, Ruderal-Schaumkraut, Viermänniges Schaumkraut, Vielstängel-Schaumkraut; **Azerbaijan** (Azerbaijani): Kələkötür ürəkotu; **Belarus** (Russian): сердечник шершавый (serdechnik shershavyy); **Belgium** (Dutch/French): kleine veldkers, cardamine hérissée; **Bulgaria** (Bulgarian): космата горва (kosmata gorva), влакнеста горва (vlaknesta gorva); **Cameroon** (JRA/West Cameroons): m'p' fogo; **China** (Chinese/Mandarin): 白带草 (bái dài cǎo), 崖儿菜 (cuī ér cài), 粗毛碎米荠 (cū máo suì mǐ jì), 见肿消 (jiàn zhǒng xiāo), 毛碎米菜 (máo suì mǐ cài), 嫩紫碎米荠 (nèn zǐ suì mǐ jì), 碎米荠 (suì mǐ jì), 台灣碎米薺 (tái wān suì mǐ jì); **Croatia** (Croatian): oštrodlakava režuha, dlakava režuha; **Cyprus** (Greek): Καρδαμίνη αδρότριχος (Kardamíni adrótichos); **Czech Republic** (Czech): řeřišnice chlupatá, řeřišnice srstnatá; **Estonia** (Estonian): kare jürilill; **Ethiopia** (Sidama/Oromo/Gedeo/Sidamigna): Arabelad, Arabeladab; **Faroe Islands** (Faroese): títlingskarsi; **Finland** (Finnish): mäkilitukka; **Georgia** (Georgian/Imereti dialect/Kaheti dialect): გარეული წიწმატი (gareuli ts'its'mat'i), მინდვრის წისმატი (mindvris ts'its'mat'i), ტყის წისმატი (t'q'is ts'its'mat'i), ველური (veluri), ციცმატი (ts'its'mat'i), ციცმატურა (tsitsmat'ura); **Greece** (Greek): καρδαμίνα (kardamína), Καρδαμίνη αδρότριχος (Kardamíni adrótichos); **Hungary** (Hungarian): borzas kakukktorma; **Iceland** (Icelandic): lambaklukka; **India** (Apatani): Pade-hama; **India** (Meitei/Manipur): Chantruk maan; **India** (South Sikkim): Titey; **Indonesia** (Dayak Desa): Inai anan; **Indonesia** (Kalimantan, Kenyah Dayak): Inai anan; **International** (Arabic): فرح زغبي (ḥarf zuġbī); **International** (Danish): rosetspringklap,

vandkarse; **International** (Dutch): kleine veldkers, ruige veldkers; **International** (English): bittercress, bristly bittercress, common bittercress, flickweed, hairy bittercress, hairy wood cress, Lady's Smock, shotweed; **International** (French): cardamine hérissée, cardamine hirsute, cardamine velue, cardamine à tiges nombreuses, cresson de muraille, cresson de vigne; **International** (German): Behaartes Schaumkraut, Gartenschaumkraut, rauhhaariges Schaumkraut, Ruderal-Schaumkraut, viermänniges Schaumkraut, vielstängeliges Schaumkraut, Weinbergs-Schaumkraut; **International** (Italian): billeri comune, billeri primaticcio; **International** (Portuguese): agrião-de-canário, agrião-menor, cardamina-pilosa; **International** (Russian): сердечник волосистый (serdechnik volosistyy), сердечник шершавый (serdechnik shershavyy); **International** (Spanish): Berro amargo, mastuerzo amargo, mastuerzo de prado, mastuerzo menor, panillas; **Ireland** (Irish): searbh-bhiolar giobach; **Israel** (Hebrew): ריעש וימדרק (kardamin sa'ir); **Italy** (Montecorvino Rovella dialect): Cardilli santi; **Italy** (Sardinia, Italian): billeri primaticcio; **Italy** (Sicily, Italian): billeri comune; **Japan** (Japanese): ケタネツケバナ (ketanetsukebana), タネツケバナ (tanetsukebana), 道種漬花 (michitanetsukebana), ミチタネツケバナ (michitanetsukebana); **Korea** (Korean): 봄맞이냉이 (bommajinang-i); **Latvia** (Latvian): skarbā ķērsa; **Lithuania** (Lithuanian): gauruotoji kartenė; **Myanmar** (Chin, Kachin, Shan): Monnyin; **Nepal** (Ilam): Chamsure jhar; **Nepal** (Rai/Sherpa): mangan sag; **Norway** (Norwegian): rosettkarse; **Philippines** (Bontoc/Tukukan, Kalinga): lampakan si payew; **Poland** (Polish): rzeżucha czteropręcikowa, rzeżucha włochata; **Romania** (Romanian): rîjnică, rjiniță; **Serbia** (Serbian): длакава режуха (dlakava režuha); **Slovakia** (Slovak): žerušnica chlpatá; **Slovenia** (Slovene): dlakava penuša; **Spain** (Catalan): cardamina hirsuta, creixens de prat; **Spanish-speaking countries** (Spanish): Berro cimarrón; **Sweden** (Swedish): bergbräsma; **Switzerland** (German/French/Italian): Behaartes Schaumkraut, billeri comune, cardamine hérissée; **Turkey** (Turkish): kıllı kodim; **Ukraine** (Ukrainian): жеруха шорстка (zherukha shorstka); **Vietnam** (Vietnamese): cải trời hoa trắng, rau tề tấm; **Wales** (Welsh): chwerw blewog.

Conservation value: -

Distribution:

Cardamine hirsuta is native to temperate and subtropical regions of the Northern Hemisphere, extending into tropical montane zones of the Old World. Its native range spans much of Europe, North Africa, the Middle East, and large parts of Asia, including the Himalayas, China, and South-east Asia. The species has also been introduced to numerous regions worldwide, particularly in the Americas, Australasia, and various oceanic islands, where it has become widely naturalised and occasionally invasive (POWO, 2025).

Habitat:

C. hirsuta occurs in moist habitats such as river shingle, waste ground, and cultivated ground, typically at elevations between 700–1,300 metres (Hedge,

1997). It is also a common weed in pot plants and gardens (Herman and Retief, 1997) and can be found in fields, vineyards, and montane to subalpine zones (Lauber et al., 2018).

Invasiveness: -

Ethnobotany:

Cultural and traditional uses: *C. hirsuta* plays an integral role in the traditional diet of people living in Asian countries. It is valued primarily for its crunchy texture and peppery taste. In Bhutan, *C. hirsuta* leaves are an important traditional ingredient in the hot relish, *ezay*, which is based on the chilli pepper *Capsicum annuum* (Yeshi et al., 2021). In the Rai and Sherpa communities in eastern Nepal, the plant is harvested during the monsoon and then dried. According to tradition, drying in the sun is intended not only to allow the plant to be stored for longer, but also to reduce the bitterness of its leaves. These leaves are then compacted in containers and left to ferment. After fermentation, the leaves are dried again and used as a traditional ingredient in the vegetable seasoning *gundruk* (Daniggelis, 2001).

In India, the plant is eaten raw in local dishes such as *Ametpa*, *Eromba*, and *Singju* among the Meitei community in Manipur (Yumnam and Tripathi, 2012). Among the Apatani people of Arunachal Pradesh, *C. hirsuta* is also used as a spicy ingredient in chutneys and salads (Bharali et al., 2017). Ethnic groups such as the Mech, Munda, Rabha, Oraon, and Dukpa living in the Sub-Himalayan Terai, Duars, and Malpahari in West Bengal consider the species to be a medicinal food source. To improve the health of the urinary tract, the boiled leaves of the plant are consumed at least twice a week (Chowdhury and Das, 2015).

Similarly, the plant is included in the diet for health purposes in South-east Asia. For this reason, in Laos, Vietnam, and Cambodia, the leaves of this plant are often included in salads (Wiart, 2006). Likewise, in the Bontoc region of the Philippines, young leaves are eaten as a healthy addition to dishes. However, in this case, they are usually consumed after being cooked (Bodner and Gereau, 1988).

On the African continent, *C. hirsuta* is known as a wild leafy vegetable among the Bemba and Lamba people living in the mountainous regions of the Katanga Plateau and the Mitumba Mountains in the Democratic Republic of the Congo. However, here the plant is important as an emergency food source and is usually consumed during periods of food shortage (Malaisse and Parent, 1985). In western Cameroon, the plant is sometimes used in leaf soups, where it serves both as a source of nutrition and a remedy for stomach ailments (Burkill, 1985).

Traditional uses of the plant in the diet are also well documented on the European continent. In Bulgaria, *C. hirsuta* was commonly used as a savoury filling for pies until the mid-20th century. It was especially popular as a dietary component during the Orthodox fasting period (Nedelcheva, 2013). Meanwhile, in Italy, particularly in Montecorvino Rovella and the Lombardy region, according to reports, this species is still used as an ingredient in traditional spring salads (Guarrera and Savo, 2016; De Natale et al., 2020). Furthermore, in the Georgian regions of Kakheti, Guria, and Imereti, the plant is used as wild greens in the preparation of *phkhali*, a traditional cold dish made from minced vegetables and herbs. To do this, it is boiled and then mixed with crushed walnuts, vinegar or pomegranate sauce, and herbs such as coriander and garlic (Łuczaj et al., 2017; Bussmann et al., 2019; Bussmann et al., 2020).

In the temperate zones of the Americas, *C. hirsuta* is also known as an edible plant. In western Chubut, Argentina, the young leaves of the plant are collected in gardens, on roadsides, and in parks, and then eaten in salads or cooked like spinach (Rapoport et al., 2009).

There are also historical references to the plant's importance in the diet of British explorers during the colonial era. According to Joseph Dalton Hooker, who served as a surgeon's assistant and

botanist during the Antarctic expedition 1839–1843, *Cardamine hirsuta* was eagerly collected by the officers of HMS *Erebus* and HMS *Terror*. Its succulent leaves, which were collected on Campbell Island, now part of New Zealand, were eaten in salads and valued primarily for their antiscorbutic properties (Hooker, 1844). In later years, in colonial Australia, the plant was even considered a 'perfect pot-herb', and its consumption was widespread throughout the colony (Maiden, 1889).

Cardamine hirsuta is a highly valued species in traditional Chinese medicine. In many regions of the country, the plant is harvested in summer and dried in the sun, after which it is used in the form of an infusion with detoxifying properties. Practitioners of traditional Chinese medicine recognise that the species is reported to be effective in alleviating the symptoms of diseases such as urethritis, cystitis, leucorrhoea, and dysentery. Externally, it is traditionally used to treat ulcers, boils, and haemorrhoids (Yeh et al., 2017; Ye et al., 2021). In Pakistan, *C. hirsuta* is also used for both external and internal ailments among the population of North Waziristan. Its powdered root is mixed with mustard oil, and the resulting ointment is used to treat wounds and dandruff (Raza et al., 2024). In addition, infusions and decoctions of the herb are traditionally considered effective in treating oral disorders, diarrhoea, cystitis, irregular menstruation, and even arthritis and insomnia. Infusions consumed regularly over a longer period of time are said to alleviate the symptoms of chickenpox. Furthermore, the leaves of the plant are used as a poultice for scorpion stings and insect bites (Butt et al., 2021). In the Indian district of Thoubal, as in Chinese medicine, Maiba and Maibi healers recognise *C. hirsuta* as a plant with detoxifying properties. It is also said to aid digestion and regulate blood sugar levels (Yumnam and Tripathi, 2012; Debala Devi et al., 2014). The situation is slightly different in West Bengal, where the species is used to treat high blood pressure in the Terai and Duars regions. This is accompanied by a rather specific dosage, because according to reports, the method is said to be effective if you consume the juice squeezed from one leaf of the plant every day. In this region, the boiled plant is also used for medicinal purposes, and it is routinely consumed to treat strangury and other difficulties with urination (Chowdhury and Das, 2015). The use of the plant to treat cardiovascular diseases is also practised among the traditional healers Bongthing, Phedangma, and Vaidya from the communities of eastern Sikkim, such as Lepcha, Bhutia, and Rai. According to their recommendations, the extract of its shoots is reported to be effective in the treatment of hypotension and heart disorders (Lepcha and Das, 2011). The diuretic properties of the plant and its use in the treatment of urinary disorders have also been recognised in Turkey (Mumcu and Korkmaz, 2018).

Cardamine hirsuta has also been used in local ethnoveterinary treatments. In southern Ethiopia, among the people living in the districts of Wondo Genet, Yabelo, Liben, and Kochere, this species is used to treat the so-called 'three-day disease', or bovine ephemeral fever, which is caused by biting midges of the genus *Culicoides*. For this purpose, local healers make a powder from the ground root of *C. hirsuta*, which is mixed with half a glass of water and administered to the sick animals intranasally for two days (Nandi and Negi, 1999; Eshetu

et al., 2015; Romha et al., 2015).

Scientific perspective: Previous studies have confirmed the pharmacological activity of *Cardamine hirsuta* (C. *hirsuta*). The hydromethanolic extract of the plant showed strong antioxidant activity. In DPPH radical-scavenging tests, it achieved an IC_{50} of 75.96 µg/mL, comparable to the 50% radical scavenging achieved by ascorbic acid at a slightly lower concentration (IC_{50} = 59.86 µg/mL). The same extract also showed hypoglycaemic properties, with 97.23% inhibition in α-amylase inhibition tests, with an IC_{50} of 73.66 µg/mL, which approached the potency of acarbose – the standard antidiabetic drug (IC_{50} = 51.77 µg/mL) (Malik et al., 2023).

These findings were also confirmed by in vivo experiments using rat models. Oral administration of the extract over 30 days significantly reduced fasting blood glucose levels from 468 mg/dL to 74.2 mg/dL at a dose of 500 mg/kg body weight. This was accompanied by improved insulin levels, a reduction in glycated haemoglobin (HbA1c), and restoration of glycogen content in the liver and muscle tissue. Furthermore, the extract improved the blood lipid profile by reducing triglyceride and cholesterol levels, and increasing HDL-C (Malik et al., 2023).

Using molecular docking, researchers discovered that compounds such as mulberrofuran-M and quercetin 3-(6″-caffeoylsophoroside) bound strongly to proteins involved in controlling blood sugar and inflammation. This suggests that the plant's antidiabetic properties may be due to the alleviation of inflammation while supporting the body's metabolic balance (Malik et al., 2023).

In addition, C. *hirsuta* also exhibits antimicrobial effects. Studies reported that, at 30 mg/mL, aqueous extracts of the plant showed a 13 mm zone of inhibition against *Escherichia coli*, while methanolic extracts showed an 11 mm zone. These results, therefore, confirmed the plant's moderate antibacterial effect, which may have implications for the plant's traditional use in the treatment of inflammation (Narzary et al., 2018).

Celosia argentea L.

Family:
Amaranthaceae Juss.

Synonyms:
Amaranthus huttonii H.J.Veitch, *Celosia argentea* var. *cristata* (L.) Kuntze, *Celosia cristata* L., *Lophoxera comosa* (Retz.) Raf.

Vernacular names:

Albania (Albanian): lafshë gjeli; **Angola** (Kikongo): sankokolo; **Benin** (Adja/Cotafon/Fon/Holly/Idasha/Mahi/Péda/Saxwè/Tchabè/Xwla): Soman; **Benin** (Ani/Anii/Bariba/Berba/Cotafon/Ditamari/Kotokoli/Mahi/Natimba/Otammari): Aléfo, Aléfô, Aléfôkinka, Aféfokenka, Èfo, Iforana; **Benin** (Boko): Gasiala, Garciala; **Benin** (Dendi): Chanwounpaata, Nannanfa; **Benin** (Fè): Odjogodo; **Benin** (Fon/Goun/Mahi): Avunvo; **Benin** (Gourmantché): Agnikpina, Ayinkpinnan; **Benin** (Holly): Tchokoognibo; **Benin** (Ifè/Tchabè/Yoruba): Tchokoyokoto; **Benin** (Mahi): Avoussigan, Djogbolo; **Benin** (M'bermin): Tipékênonté; **Benin** (Péda/Watchi): Avouvô; **Benin** (Tchabè): Adjobodo, Odjogodo, Tainmilaamon, Tètèkpo; **Benin** (Toli/Ouémaingbé): Tchokoto; **Benin** (Wama): Yonbinanbitinan; **Botswana** (Tswana): Thepe; **Brazil** (Bahia): celosia branca, crista de gallo, veludo, veludo branco; **Brazil** (Ceará/Alagoas): Beijo de palmas; **Brazil** (Pernambuco): Bredo de namorado; **Brazil** (Portuguese): crista-de-galo, suspiro; **British Honduras** (Spanish): amor seco; **Central America** (Spanish): borla, cresta de gallo, san José, terciopeio; **Cuba** (Congolese/Bantu): Siguá; **Cuba** (Lucumí/Yoruba): Biolè; **Cuba** (Spanish): acediana, arcediana; **Czech Republic** (Czech): nevadlec hřebenitý; **Democratic Republic of the Congo** (Coquilhatville): bolongo, bossongo; **Democratic Republic of the Congo** (Ikavangoula): komanai; **Democratic Republic of the Congo** (Kabinda): kananga; **Democratic Republic of the Congo** (Kasongo): moniama; **Democratic Republic of the Congo** (Lomongo): yendju; **Democratic Republic of the Congo** (Lukafu): momengela, mulimbi; **Democratic Republic of the Congo** (Manganga): n'tsabi; **Democratic Republic of the Congo** (Mayumbe): n'sakongo; **Democratic Republic of the Congo** (Miao): molengalenga; **Democratic Republic of the Congo** (Ngombe): boangiemo; **Democratic Republic of the Congo** (Nouvelle-Anvers): koseko; **Democratic Republic of the Congo** (Tanganika): mossaova-sabi; **Ecuador** (A'ingae): Arapa mezanzafa; **Ecuador** (Spanish): cresta de gallo; **Ecuador** (Tsáfiki): Wal'pa luli; **El Salvador** (Spanish): san José, terciopelo; **Ethiopia** (Amharic/Tigrinya): belbila, birsir, shilobai; **Ethiopia** (Hamar): Torchata, Torcha; **Ethiopia** (Konso): Horbaita; **Finland** (Finnish): kukonharja; **Ghana** (Adangme-Krobo): Tobo; **Ghana** (Akan): Nkyewodue; **Ghana** (Mano): sokoto; **Guatemala** (Spanish): abanico, amaranto, cresta de

gallo, flor de memo, mano de león; **Honduras** (Spanish): mono; **Hungary** (Hungarian): ezüst celózia; **India** (Bengali): Svet-murga, swet murga; **India** (Gujarati): Lápadi; **India** (Hindi/Rajasthani): Chhil-chil, Sarwari, Sar-pankha, Salyara, Sil, debkoti, ghogiya, safed murgha (sufaid murgha, sufed murgha, safed murghkes); **India** (Kannada): Goraji; **India** (Marathi): kurdu, kurdu kurada, kudhu; **India** (Punjabi): chilchil, salgara, sarpankha, sil; **India** (Santali): sirgit arak; **India** (Sindhi): sarwali, ucha-kukur; **India** (Tamil/Kannada/Telugu/Sanskrit/Hindi/Marathi/Malayalam): anesoppu, annaesoppu, anne soppu, barhichuda, barhisikhi, belutta-adeca-manjen, cavarcuttuppannai, cavarkontai, cavarpannai, cerucira, cevalkontaicceti, cevarpannai, cevarpu, chilmil, erra kodi juttuthotta koora, ettakodiyuttatotakuru, gadrya, garke, garkha, gulugkura, gunugu, hanne soppu, hunjada juttu, imarti, indivara, jadadhari, jataadhaari, kanne hoo, karadoo, kekishikha, khadaka thira, khadakatheera, kirdu, kodi juttu, kodi juttu chettu, kodijuttu thottakoora, kodijuttutotakura, kokan, kolijuttina gida, ksetrabhusha, kukari, kurada, kurandika,

kuranta, kuruntika, kurutah, kuvakutah, lalmurga, madhuchada, makhamal, makili-k-kirai, mayoora shikhe, mayura shikhi, mayurachuda, mayurasikha, mayurshikha, mayurslka, morachendya, morashendya, morashikha, mullancira, nilakanthashikha, oarka, pannai, pannai keerai, pannaikeerai, pattura, pilamurghka, rudrajata, sahasrahi, sarvali, sarvari, sarwari, shikha, shikhalu, shikhibala, shikhini, shitivaaraka, shtivara, shveta-murga, sa ti bi ra, si ti bi ra, sikih, siravalika, sirivalika, sirsamanjari, sitavaraka, sitivamaraka, sitivara, sitivarah, sitivaraka, srivarakah, sucipatrah, sunishannaka, surali, surli, survari, sushikha, tanduliyah, tsjeria-belluta-adeca-manjen, velud, vitunna; **India** (Telugu): gurugu, gurugu aaku, guruvu kura, panche chettu; **India** (West Bengal): swetmurge; **Indonesia** (Javanese): bajem djengar ajam, bajem mera djambu, bajem singang puti; **Indonesia** (Kaili Rai): Boroco; **Indonesia** (Malay): balung ayam, balung ayam ungu, balung ekor belanda, bayam ekor kuching, bayam ekur kuching, bayam merah, bunga balong ayam, bunga merah, boenga tali, boroco, piai ayam, pial ayam; **International** (Danish): hanekam; **International** (Dutch): hanekam; **International** (English): celosia, cockscomb, common cockscomb, crimson cockscomb, fireweed, Jesus' plant, Lagos spinach, quail grass, red fox, silver and red foxtail, silvery cockscomb, silvery celosia, woolflower; **International** (French): amarante crête de coq, célosie, célosie argentée, célosie laineuse, crête de coq, gran margrit, grande immortelle, krèt kok; **International** (German): Celosie, Hahnenkamm, Silberhahnenkamm, silbriger Brandschopf; **International** (Italian): celosia immortal, fior di velluto, sciamito cresta-di-gallo; **International** (Mandarin): 青葙 (qīng xiāng), 雞冠花 (jī guān huā); **International** (Portuguese): amaranto branco, Flòr dos amores, Martinetes, Velludilhos; **International** (Russian): петуший гребешок (petushiy grebeshok), целозия гребенчатая (tselezia grebenchataja), целозия серебристая (tselezia serebristaya); **International** (Spanish): albahaca plateada, amor seco, boria, cresta de gallo, mirabel, moño; rabo de conejo**; Japan** (Japanese): ノゲイトウ (nogeitô); **Kenya/Tanzania** (Swahili): mfungu; **Korea, Republic of** (Korean): 개맨드라미 (gae maen deu ra mi), **맨드라미** (maen deu ra mi); **Lesotho** (Sotho): poea; **Liberia** (Mano): boh; **Malawi** (Chichewa/Tumbuka/Nsanje): chala cha nkhwale, chinkanya, kaphikaulesi, munsungwe, ndangale, nsanzazywale, nyasungwi; **Martinique** (French/Creole): amarantine, immortelle blanche, immortelle rouge; **Mesoamerica** (Spanish): abanico, cresta de gallo, flor de memo, mano de león, penachos, terciopelo; **Mexico** (Náhuatl): selaxochitl; **Mexico** (Totonaco): tsua-caca, tsutsuco (tsuusuco); **Myanmar** (Burmese): crested cock's comb, kyet-mauk, silver cock's comb, wild cock's comb; **Nigeria** (Arabic): sheiba; **Nigeria** (Edo): aborra, ebe-afor; **Nigeria** (English): Lagos spinach, cockscomb, quail grass, woolflower; **Nigeria** (Hausa): áláyyohuó, farar áláyyafó, riimii; **Nigeria** (Igbo): eriemionunu; **Nigeria** (Tiv): igyar′; **Nigeria** (Yoruba): ajefous, àjẹmáwọ́fọ̀, àjẹfáwo, aje fo awo, soko, sokoyokoto, sokoyokoto pupa, soko yòkòtò, sokoto, shoko, yoko; **Norway** (Norwegian): sølvamarant; **Panama** (Spanish): abanico; **Persia** (unspecified): Gjul aiimar; **Peru** (Spanish): celostia, cresta de gallo, gallo cresta, hierba de la sangre; **Poland** (Polish): celozja srebrzysta; **Senegal** (Manding-Bambara): ngo ban ku; **Senegal** (Wolof): putrèp mbam; **Sierra Leone** (Krio): shokoto-yokoto; **Sierra Leone** (Mende): kikpoi, kipoi, kpange, yogoto; **Sierra Leone** (Susu – Dyalonke): tenge-na; **Sierra Leone** (Temne – Kunike/Port Loko/Sanda/Yoni): an-lami, an-kokoro; **South Africa** (Afrikaans): Hanekam, Kalkoenslurp, misbredie, rooibossie, sprinkaan-bossie; **South Africa** (Swati): isheke; **South Africa** (Xhosa): Umtyutu; **South Africa** (Zulu): Umbuya; **Sri Lanka** (general): Kurdu; **Sri Lanka** (Sinhala): කිරිහැන්ද (kirihanda), kirihenda, shitivaraka, vitunna; **Sudan** (Arabic): Bambit, danab el kelb, sheiba; **Sudan** (Arabic/Kordofan): bambit, danab el kelb, el bueida, sheiba; **Sweden** (Swedish): celosia, tuppkam; **Taiwan** (Formosan/Chinese): adiping, cuun rapi' i patunanga (tsuun rapi ee patunanga), 土雞冠 (tǔ jī guān), 崑崙草 (kūn lún cǎo), 白雞冠 (bái jī guān), 草決明 (cǎo jué míng), 草蒿 (cǎo hāo), 野雞冠花 (yě jī guān huā), 野雞頭 (yě jī tóu); **Ukraine** (Ukrainian): целозія гребінчаста (tseloziia hrebinchasta); **Vietnam** (Vietnamese): đã kê quan, bông mào gà trắng, đuôi lươn, mào gà trắng, thanh tương tử; **Zambia** (Nyanja): kalume, kapiko, kapikolesi, lukuli; **Zimbabwe** (Chewa/Ndebele/Tonga): isihlabe, mundawarara, sunku.

Conservation value:

Least Concern - LC (IUCN, 2025)

Distribution:

Celosia argentea is native to tropical regions of Africa, where it occurs across a wide range of countries from

West to East Africa and southwards into Zambia and Malawi. Beyond its native range, the species has been widely introduced across many tropical and subtropical regions worldwide, including parts of Asia, the Americas, Oceania, and various islands. Its broad introduction reflects its adaptability to diverse climates and habitats, making it a common component of disturbed and cultivated areas globally (POWO, 2025).

Habitat:

Celosia argentea inhabits a range of terrestrial and wetland environments, commonly occurring in savannas, shrublands, grasslands, and inland wetlands. The species thrives in disturbed areas and is often found in both natural and anthropogenic habitats (Ghogue, 2020d).

Invasiveness: -

Ethnobotany:

Cultural and traditional uses: In traditional food cultures, *Celosia argentea* is known as an important dietary source. Its culinary importance in sub-Saharan Africa is reflected in the local Yoruba names for the plant. The name *soko yòkòtò* loosely translates as 'make your husband robust'. The names *àjẹmáwọfọ* and *àjefáwo*, in turn, mean 'that which is eaten until the plate is broken' (Ilori et al., 2016; Williams, 1993; Ndimele, 2016). Among speakers of Yoruba, the leaves and stems of the plant are eaten as a vegetable, which is stewed or cooked in soups or sauces made from tomatoes, onions, and palm oil. The cooked plant is often served with meat and starchy foods such as rice, yams, maize, or manioc (Williams, 1993; Grubben and Denton, 2004; Fayaz et al., 2019). In The Gambia, the plant is said to give rice-based dishes a slightly sour taste (Burkill, 1985). Due to its wide range of uses, the plant is often cultivated by Nigerian farmers and sold in small bunches at local markets (FAO, 1988; Adegbaju et al., 2019). The situation is similar in Benin, where the variety *Celosia argentea* var. *cristata* is particularly popular. Due to its nutritional properties, this plant is both cultivated and harvested in the wild, and sold at local markets year-round (Achigan-Dako et al., 2010). Among the Akan people of Ghana, young leaves of *Celosia argentea* are a popular ingredient in dishes and are usually prepared in a similar way to spinach (Abbiw, 1990). The plant is also consumed in Sierra Leone, where the name *shokotoyokoto* is a variant of the aforementioned Yoruba term (Burkill, 1985; Williams, 1993). In Central Africa, specifically in the Democratic Republic of the Congo, *Celosia argentea* is known as a potherb and is also consumed as a cooked vegetable (Hauman, 1951; Williams, 1993). This plant is also valued as a vegetable and consumed after cooking in Southern Africa, mainly in countries such as Malawi, Angola, Namibia, Zimbabwe, and Zambia (Williamson, 1943; FAO, 1988). In East African countries such as Ethiopia and Kenya, however, this species is less commonly eaten and regarded as an emergency food source, including among the Maasai (Grubben and Denton, 2004; Eshete et al., 2016).

Celosia argentea has been a valued food source on the Asian continent for centuries. In 19th-century reports, we can find references to this species being important both as a source of daily food and as a safeguard in times of famine. Traditionally, the young plant was eaten with salt and pepper and was described as a basic but reliable dish (Dymock et al., 1893). In China, *Celosia argentea*, known as a weed of rice and flax fields, was also harvested in order to be used as a cooked vegetable and to obtain seeds, which were then stored for their medicinal properties (Balfour, 1885; Grubben and Denton, 2004). There are reports that *Celosia argentea* was consumed during the Second World War by prisoners of war in Thailand, thereby protecting them from extreme nutrient deficiencies resulting in diseases such as beriberi and pellagra (Burkill, 1985). In Oceanic countries such as Papua New Guinea and Polynesia, it is also known as a food plant, but it is much more valued for its allelopathic properties, which promote the growth of taro (Williams, 1993;

Burkill, 1985).

Although *Celosia argentea* is not native to the Americas, it has also been recognised there as a possible food source. Nevertheless, it is much less popular as a food plant than on the continents described above. There are reports of consumption of this species collected in the wild among the Awa people in Ecuador (de la Torre et al., 2008). According to available reports, it is also known as an edible plant in Mexico, Brazil, Peru, Guatemala, Martinique, and the Caribbean, but it is mainly recognised in these regions for its non-culinary uses (Standley and Steyermark, 1946; Cabrera, 1954/1984; Martínez Alfaro et al., 1995).

In the context of traditional medicine, *Celosia argentea* is a species known as a medicinal herb throughout the African continent. Practitioners of traditional Yoruba medicine in Nigeria describe this plant as having 'cooling' properties. It is usually administered to people recovering from illness to restore their vitality and internal balance (Williams, 1993; Ilori et al., 2016). In addition, the seeds of this species are valued for their effectiveness in combating parasitic infections, such as roundworms and nematodes, and in treating diarrhoea (FAO, 1988; Abbiw, 1990). The traditional use of juice extracted from the plant is also known, which is used topically on skin rashes. The seeds are also ground into a paste and used in the same way for dermatological ailments (Egharevba and Ikhatua, 2008). The Akan people of Ghana particularly value decoctions made from the above-ground parts of the plant, which are drunk to treat vitamin C deficiency and scurvy, or used as an enema to treat parasitic infections (Abbiw, 1990). Similarly, in The Gambia, the plant is consumed as a food source and is considered to support proper bowel function and prevent scurvy (Burkill, 1985). In the Democratic Republic of the Congo, the seeds of *Celosia argentea* are primarily used to treat gastrointestinal disorders (Hauman, 1951). Also in Ethiopia, the seeds of the plant are taken to treat diarrhoea. In some regions, the flowers of this species are used as a remedy for dysentery and muscle pain (Grubben and Denton, 2004; Eshete et al., 2016). The Kenyan Maasai use decoctions of the plant as a body wash. It is used primarily among people recovering from illness. However, the sources do not specify whether this treatment is related to medicinal or ritual practices (Burkill, 1985; Grubben and Denton, 2004). The Maasai also use the roots of the plant, which are crushed and administered to treat conditions such as colic, gonorrhoea, and eczema. In addition, the whole plant is sometimes used as an antidote for snakebites (Grubben and Denton, 2004).

Celosia argentea plays an important role as a medicinal plant in traditional Indian medical systems such as Ayurveda and Unani. The seeds of the plant have long been valued for their high efficacy in treating diarrhoea and other intestinal disorders (Dymock et al., 1893; Kirtikar and Basu, 1918). The Indian Santal community traditionally extracted oil from the seeds, which was also used for the above medicinal purposes (Dymock et al., 1893). The roots of the plant have been used in Ayurvedic practices as a detoxifying agent in cases of excessive cannabis consumption. Meanwhile, a decoction of the seeds consumed with buttermilk is taken to treat painful or difficult urination (Dastur, 1978). An ointment made from the plant's leaves and honey is applied topically for skin inflammation, abscesses, and snakebites (Burkill, 1985; Grubben and Denton, 2004). According to historical records, in ancient Persia, the seeds of the plant were also known as a powerful aphrodisiac and general regenerative agent. A recipe recorded in the Persian Muffaridat-i-Nasiri indicates that a preparation with such effects was obtained from 180 seeds mixed with an equal amount of sugar (nabat), then stirred into milk (Dymock et al., 1893; Dastur, 1978).

In China, the plant is traditionally used to treat a wide range of conditions. According to available Chinese medical records, the cooling and slightly bitter seeds of *Celosia argentea* form an important part of preparations aimed at 'cleansing the liver of heat' and general detoxification of the

body. In addition, these seeds are administered for conditions such as eye inflammation, headaches, dizziness, childhood convulsions, hypertension, haemorrhoids, and intestinal bleeding (Henan Provincial Editorial Committee, 1962; Zhejiang Provincial Health Bureau, 1985). For the treatment of ocular disorders such as night blindness and corneal opacity, a tonic prepared from seeds boiled with rice and sugar is used. The leaves, on the other hand, are used externally for various skin problems (Balfour, 1885; Grubben and Denton, 2004;). With regard to Vietnam, preparations from the plant are traditionally used to treat red and watery eyes, boils, mouth ulcers, dysentery, bloody stools, and general inflammation (Đỗ Tất Lợi, 2004).

for treating heat-related ailments. The plant is often grown in home gardens and used for medicinal purposes, or sold as a medicinal herb at local markets (Martínez Alfaro et al., 1995).

In South America, *Celosia argentea* var. *cristata* is primarily used for medicinal purposes. The Tsa'chi people in the Ecuadorian province of Pichincha traditionally use both its leaves and flowers to treat anaemia and various circulatory disorders (de la Torre et al., 2008). Anaemia is also treated with this plant in Peru. In addition, local healers use it to treat diarrhoea, scurvy, and fever. For this purpose, it is administered as a decoction or consumed as a dish (Delgado Súmar, 2018-2019). In Brazil, the seeds have long been valued primarily for their anti-worm

Moving to Central America, there are reported uses of the plant in Mexican folk medicine. Similar to Ethiopia and Vietnam, infusions and macerates prepared from the whole plant are taken orally to treat dysentery. In local medical classifications, the plant is described as 'cold', making it suitable

and anti-scurvy properties, which are consistent with the uses of the plant known in Africa and Asia (Corrêa, 1926b).

Celosia argentea is also used in animal husbandry, primarily as a source of feed. In Nigeria, where the plant is mainly grown for human consumption,

farmers often use lower-quality crops and surpluses as an additional source of animal feed. The plant is used in the same way in other African countries where it is considered a food plant (FAO, 1988). Also in India, the plant is not only cultivated as a vegetable, but also traditionally as a source of feed for buffaloes (Balfour, 1885; Zeven and de Wet, 1982). The plant was used historically in a similar way in Indonesia. At the end of the 19th century, Dr A. Preyer documented its use as a fodder plant for horses and cattle in Java. According to his notes, this was mainly due to its digestibility and the species' ability to adapt to the climate (Preyer, 1897). However, none of the available materials have noted its importance in any traditional veterinary treatments.

Another use of the plant, this time in a technical context, is the extraction of fibre. The fibrous stems of the plant are harvested for the production of ropes and cords in countries such as the Democratic Republic of the Congo and Senegal (Williams, 1993). The plant is also cultivated for fibre extraction in India (Zeven and de Wet, 1982).

In addition to the above-mentioned uses, *Celosia argentea*, and especially its var. *cristata*, is valued on all continents for its ornamental value. In West Africa, particularly in countries such as Benin, Nigeria, and Ghana, *Celosia argentea* var. *cristata* is often used for decorative purposes during local festivals or to enhance the attractiveness of various displays. This is due to its comb-like inflorescences. In Japan and much of South-East Asia, the plant is cultivated as an ornamental in home gardens (Balfour, 1885; Grubben and Denton, 2004). In Myanmar, the plant has traditionally been valued by women, who use its flowers to decorate their hair (Corrêa, 1926b).

Celosia argentea has a similar significance in the Americas. In Ecuador, in particular, it is planted as a decorative low hedge (de la Torre et al., 2008). The var. *cristata* is considered a key ornamental plant in the gardens of people living in Central America and northern South America (Corrêa, 1926b; Standley and Steyermark, 1946; Delgado Súmar, 2018-2019). The plant is also important in local ritual traditions. In the present-day Democratic Republic of the Congo, *Celosia argentea* has been symbolically planted as part of rituals to increase crop abundance and protect later harvests (Hauman, 1951; Burkill, 1985; Williams, 1993). In central Sumatra, it is planted to calm protective spirits during occult rituals (Burkill, 1985). Furthermore, in Mexico, the flowers of this species play an important role in the celebration of All Saints' Day, where they are used to decorate family altars (Martínez Alfaro et al., 1995). In Brazil and Peru, *Celosia argentea* appears in Afro-Latin American ceremonial traditions, where its presence has a symbolic protective meaning (Corrêa, 1926b; Delgado Súmar, 2018-2019). Belief in the protective significance of the plant is particularly evident in Afro-Cuban Caribbean traditions. Known as Acediana, it is associated with Orisha deities such as Orula and Aggallú. The plant is used there in spiritual rituals for healing and protection. The dried and powdered plant is placed in amulets to increase the courage and eloquence of the person wearing them (Cabrera, 1954/1984; Delgado Súmar, 2018-2019).

Today, *Celosia argentea* is both cultivated and found as a weed in Europe. During archaeological research, it was found in Egyptian tombs from the Greco-Roman period in the Hawara necropolis, and it probably spread to Europe during this period (Neumann et al., 2003). This introduction probably took place during the Ptolemaic and Roman periods, when Egypt maintained strong cultural and trade links with Greece and Rome (Joret, 1897). The plant was already cultivated in ancient Greece, although its exact use is still unclear (Corrêa, 1926b). According to historical records, the plant began to be cultivated in France as an ornamental garden flower in 1854, and, around the same time, it also appeared in gardens in other European regions (Millet-Robinet, 1859).

Scientific perspective: The leaves of *Celosia argentea* are characterised by a high crude protein content (2–4%). According to available studies, they can provide approximately 1–2 g of protein per meal (assuming a ~50 g cooked serving), which

corresponds to 2–5% of the recommended daily intake for adults (FAO, 1988; Williams, 1993). Analyses of the plant's nutritional value have also shown that its fresh leaves contain significant amounts of calcium (178.08 mg per 100 g) and iron (15.25 mg per 100 g). In addition, per 100 g of fresh leaves there are 410 mg of ascorbic acid, significant amounts of β-carotene (48.2 IU; ≈ 29 μg), and vitamin E (28.3 mg) (Williams, 1993; Adegbaju et al., 2019). This plant also contains micronutrients such as magnesium, zinc, and phosphorus, as well as approximately 3.53% fibre. Nutritional analyses have shown that the seeds of *C. argentea* contain approximately 30.8% starch, 15.6% protein, and 6.5% fat (Henan Provincial Editorial Committee, 1962). *Celosia argentea* is also rich in amino acids, including significant amounts of lysine, leucine, isoleucine, phenylalanine, arginine, histidine, threonine, and glutamic acid (Williams, 1993; Adegbaju et al., 2019).

The plant's widespread use in folk medicine is also supported by its phytochemical composition. Early observations by Carl Wehmer (1929) documented the significant presence of fatty oils in the seeds of this species. These oils have been classified as active agents contributing to the anti-inflammatory and haemostatic effects of the plant (Zhejiang Provincial Health Bureau, 1985). Contemporary research has shown that their properties are influenced by the celogenamides, alkaloids, flavonoids, phenolic glycosides, and betalains they contain (Adegbaju et al., 2019). Recent studies have also allowed the isolation of bicyclic peptides — celogentins A–C — and moroidin, which have antimitotic potential. This would further indicate the cytostatic or antiproliferative properties of the plant's seeds. In addition, the polysaccharide celosian, extracted from the seeds, has been shown to have hepatoprotective and immunomodulatory properties, which would support the use of the plant in the treatment of liver disorders (Grubben and Denton, 2004).

Pharmacological studies on *Celosia argentea* have also documented the plant's antidiabetic properties. Seed and root extracts have shown hypoglycaemic activity in animal models. Furthermore, methanolic extracts from leaves and seeds have shown cytotoxicity, indicating a possible anticancer potential (Adegbaju et al., 2019). Antimicrobial tests using the above extracts have shown activity against a wide range of bacterial and fungal pathogens, as well as anthelmintic activity, further justifying the traditional uses of the plant. The plant has also been shown to inhibit the formation of calcium oxalate crystals, which may be useful in the prevention of kidney stones (Adegbaju et al., 2019).

Nevertheless, regular consumption of this species for food and medicinal purposes may be limited by its relatively high oxalate content. Although cooking can reduce their concentration by 25–50%, excessive consumption of the plant can lead to oxaluria, especially in people prone to kidney stones (Williams, 1993). Regardless, from a toxicological point of view, this plant is considered safe for human consumption (Fayaz et al., 2019).

Centella asiatica (L.) Urb.

Family:
Apiaceae Lindl.

Synonyms:
Hydrocotyle asiatica L., *Centella hirtella* Nannf., *Hydrocotyle ficarioides* Lam.

Vernacular names:
Angola (Muila): mafoibale; **Argentina** (Spanish): centella asiática; **Australia** (Yaegl community): centella; **Bangladesh** (Bengali/Chittagong): pahartali; **Bangladesh** (Santhal community, Naogaon district): thankuni; **Brazil** (Portuguese): acariçoba, bevilaqua, centela, centella, erva de clavo, herva capitão, pé-de-cavalo; **Brunei** (Malay): pegaga; **Burundi** (Kirundi): gutwikumwe; **Cameroon** (Babungo): nid; **Cameroon** (French/unspecified): chicleton; **Cameroon**

(ghomala'a): lin wou wou; **Cameroon** (Lingala): ilembetene; **Colombia** (Spanish): gotu kola, hidrocotile, hidrocotile asiática; **Cook Islands** (Rarotongan): kapukapu; **Côte d'Ivoire** (Kru-Guere): létébo; **Côte d'Ivoire** (Kweni): palétrui; **Cuba** (Spanish CU): oreja de ratón; **Czech Republic** (Czech): pupečníkovec asijský; **Democratic Republic of Congo** (Kikongo): kidoka-doka, tshiwa-mwando; **Democratic Republic of Congo** (Lokele): toto tolo; **Democratic Republic of Congo** (Mashi): gutugumwe, kurhwirikuguma, murhulanyumpa; **Democratic Republic of Congo** (Nyindu): majikikiura, mugunduzimu; **Democratic Republic of Congo** (Shi): kurhwirikuguma; **Ethiopia** (Afaan Oromo): baala buqqee; **Ethiopia** (Amharic): yeayit joro; **Ethiopia** (Araf/Ari): ountinkam; **Ethiopia** (Konta): ecare haythaa; **Ethiopia** (Maale): busino, etsewayo; **Ethiopia** (Omotic): tikus-asht; **Ethiopia** (Sheko): yetinti-charo; **Ethiopia** (South Omo – Kure and Bitsmal): ountinkam; **Fiji** (Fijian): tatandra, tododro, totono; **Finland** (Finnish): rohtosammakonputki; **Hungary** (Hungarian): azsiai gázlófű; **India** (Assam): manimuni; **India** (Assamese): বৰ মানমুনি (bor manimuni); **India** (Assamese/Mising): manimuni; **India** (Bengali): thalkuri, olkuri, bora thulkari, jholkhuri, ব্রহ্মমন্ডূকী (brommomonḍūki), থানকুনি (thankuni); **India** (Bengali/Birbhum region): thunkuni, changchi khiat; **India** (Bihar): chokiora; **India** (Deccan): vallarai; **India** (Goan Konkani): उंदरी (undari); **India** (Gujarati): barmi, karbrahmi, moti brahmi, ખડબ્રાહ્મી (khadbrahmi); **India** (Hindi): bemgsag, brahma-manduki, gotukola, khulkhudi, mandookaparni, बल्लारि (ballāri), भेकी (bheki), ब्राह्मी (brahmi); **India** (Hindi/Sanskrit): brahmi, mandukaparni; **India** (Indo-Nepal sub-Himalayan region): brahambuti; **India** (Kannada/Kanarese): vondelaga, ಒಂದೆಲಗ (ondelaga), ತಂಬುಳಿ ಗಿಡ (tambuli gida), ಬ್ರಹ್ಮಿ ಸೊಪ್ಪು (brahmi soppu), ಗಡ್ಡೆ ಬರಗ (gadde baraga), ಇಲಿಕೆವಿ ಸೊಪ್ಪು (ilikivi soppu), ಸರಸವತಿ ಸೊಪ್ಪು (sarasvati soppu), brahmisoppu, urage, vandelagaillikiwigidda; **India** (Kashmiri): brahmabuti; **India** (Konkani): ekpanni; **India** (Malayalam): kodagam, kodangal, kutakan, kudangal, kudavan, kutakm, kutannal, muthal, muttil, muththil, muyalchevi, കുടകം (kuṭakam), കുടഞ്ഞാല് (kuṭaññāl); **India** (Manipuri): পেৃক (peruk); **India** (Marathi): brahmi, karinga, karivanaj, karingaj, एकपानी (ekpani), कारविणा (karivana), undri; **India** (Meghalaya): bat-maina; **India** (Odia): ମଣ୍ଡୂକପର୍ଣ୍ଣୀ (maṇḍūkaparṇṇī), ମୂଳ ପର୍ଣ୍ଣୀ (mūḷa parṇṇī), ସରସ୍ୱତୀ (sarasvati), ଶ୍ରାବଣୀ (śrābaṇī), ସୋମ ବଲ୍ଲୀ (soma ballī), thalkudi; **India** (Sanskrit): brahmi, brahmamanduki, brāhmibheda, darduchhada, divya, mandukaparni, supriya, tvasthi, bhekaparni, भाण्डि (bhāṇḍi), भण्डीरी (bhaṇḍīrī), मण्डूकपर्णी (maṇḍūkaparṇī); **India** (Tamil): babassa, ballau, kasappi, madanți, paruṇi, piṇṭīri, vallaarai-kire, vallarai, யோசனவல்லி (yōcaṉavallī); **India** (Telugu): babassa, babassailaka, bekaparnamu, bokkudu, bokuduchettu, manduka, manduka-brummi, mandukbrahmmi, saraswati aku, saraswati plant, vauari, మండూకపర్ణి (maṇḍūkaparṇi), సరస్వతీ ఆకు (sarasvatī āku); **India** (Tripura): thankuni, thunimankuni; **India** (Tulu): ತಿಮರೆ (timare); **India** (Urdu): brahmi; **India** (Urdu/Dakhini): vallarij, brahma-manduki; **Indonesia** (Alf. Min. Batu): daroc-daroc; **Indonesia** (Alf. N. O. Halma): sorowai; **Indonesia** (Ambon Malay): roempoet kaki koeda; **Indonesia** (Atjeh): pegaga; **Indonesia** (Bali): paidoeh, panggaga; **Indonesia** (Balinese Kr.): panggowang; **Indonesia** (Boeg.): daotcoengkoeongke, tjipoe balawo; **Indonesia** (Indonesian): daun pegaga, ekstrak kental herba pegagan, pegagan, rendeng; **Indonesia** (Javanese): calingan rambat, gagan-gagan, ganggagan, kerok batok, pantegowang, panigowang, panggowang, pegagan, rendeng; **Indonesia** (Madoera): ghangghagan, kos tekosan; **Indonesia** (Makassar): pagaga, pegaga, wisoe-wisoe; **Indonesia** (Malay Batavia): pegagan; **Indonesia** (Menado): roempoet kolottidi; **Indonesia** (Minangkabau): pagago, poegago; **Indonesia** (Old Javanese): gagan-gagan; **Indonesia** (Saleijer): hisoe-hisoe; **Indonesia** (Sasak): bebele; **Indonesia** (Sawoe): kelai lere; **Indonesia** (Sundanese): antanan, antanan boncer, antanan gede, antanan gondrong, antanan rambat, kurawet galeung, patjoel gowang, tjowet gompeng; **Indonesia** (Ternate): kolottidi magofoe, kolotidi menorah; **Indonesia** (Vulg. Malay): kaki koeda; **International** (Danish): asiatisk centella; **International** (Dutch): brahmi, gotu kola; **International** (English): Asian coinleaf, Asiatic pennywort, Bubbles, coinwort, coastal water-hyssop, gotu kola, Ibdiab Pennywort, Indian pennywort, Little Pig's Ears, Marsh Pennywort, Marsh Pepperwort, pennywort, pennyweed, sheep-rot, spadeleaf, tiger herb, Urban Marsh Pepperwort, water hyssop, wild violet; **International** (French): bevilacque, centelle asiatique, centelle d'eau, écuelle d'eau, fausse violette, herbe boileau, herbe du tigre, hydrocotyle asiatica, hydrocotyle indien, hydrocotyle asiatique; **International** (German):

asiatische sumpfpfennigkraut, asiatischer wassernabel, indischer wassernabel; **International** (Latin): Herba centellae, Hydrocotyle asiatica; **International** (Mandarin Chinese): 积雪草 (jī xuě cǎo), 崩大碗 (bēng dà wǎn), 马蹄草 (mǎ tí cǎo), 铜钱草 (tóng qián cǎo), 雷公根 (léi gōng gēn), 落得打 (luò dé dǎ), 地棠草 (dì táng cǎo), 蚋仔草 (ruì zǐ cǎo), 蚶殼草 (hān ké cǎo), 含殼草 (hán ké cǎo), mijupamao; **International** (Portuguese): centela, pangana; **International** (Russian): центелла азиатская (tsentella aziatskaya); **International** (Spanish): antanan, brahmi, gotu kola, hierba de clavo, oreja de ratón, pegaga, sombrerito; **Japan** (Japanese): アカマメゴケ (akamame-goke), gotukola, gotuko-lusa, イハマメ (ihamame), イシマア (ishimaa), ツボクサ (tsubokusa), チヂミツボクサ (chijimi-tsubokusa), カタンノクラ (katan no kura), 螺髻草 (raikeisō); **Kenya** (Swahili): mupunga; **Laos** (Lao): phak nok/phaknok, phalwaen; **Laos** (Phongsaly and Oudomxay): phak nok; **Lesotho** (Sotho): bolila-ba-linku, bolila-balinku, bodila-badinku; **Lithuania** (Lithuanian): azijinés centelés žolé; **Madagascar** (Antakarana, Betsimisaraka): anamanitra, anantahalaka, anantalapetraka, fiaremana, kapilantsahona, kapilantsirevo, kiladitahalaka, korokorona, loviantsahona an-tanety, raivolesoka, silabola, talapetraka, viliantsahona an-tanety; **Madagascar** (Betsimisaraka): talapetraka; **Madagascar** (Malagasy): anamanitra, herbe boileau, korokorona, loviantsahont, talapetraka; **Malaysia** (French Creole/English): herbe boileau, centella; **Malaysia** (Japanese, transliterated): ツボクサ (tsubo-kusa), チヂミツボクサ (chijimi-tsubokusa); **Malaysia** (Malay): antanan, daun cina, daun kaki kuda, daun pegaga, gagan-gagan, gotu kola, panacea, pegaga, pegagan, pengaga, pigaga, pugaga, tapak kaki kuda, dawoopungah-gah; **Mexico** (Spanish): centella, hierba; **Myanmar** (Burmese): hlahnip chai, minkhuabin, mrang-khua, myin-hkwa/myin-kwar, pa-na-e-khaa-doh, ranjneh hnah, tungchian, matoya-huho/matoyahuhu; **Myanmar** (Myanmar, Chin, Mon): hlahnip chai, myin-hkwa, myin-khwar pin, ranjneh hnah; **Nepal** (local): ghodtapre; **Nepal** (Nepali): brahambuti, घोडटाप्रे (ghoḍ ṭāpre); **Nepal** (Nepali and ethnic dialects): bakucha ghyan, bhuin jhar, chhimile, dokni, ghotap, ghotapa, ghotapre, ghotaprya, ghumen, golpat, jasundo, khocha, kholcha ghyan, lakphesungm, lemsyu, nagasalamran, phirumuk, salakha, tajhawai, tilikosyo, tin aankhle, tobre, topre jhar, yuklamwasun; **Norway** (Norwegian): asiatisk skjoldblad;

Palau (Palauan): elisichur; **Philippines** (Baggao, Cagayan): lapalapa; **Philippines** (Bauko-Kankanai): matmata; **Philippines** (Bontok): sipsipping; **Philippines** (Cebuano): hahanghalo; **Philippines** (Filipino): takip-kohol; **Philippines** (Hanunuo): dulud; **Philippines** (Hiligaynon): yahong-yahong; **Philippines** (Isnag): alunit, dalunit; **Philippines** (Ivatan): kalabasan-karam, tagaditak; **Philippines** (Kalahan): kannapa; **Philippines** (Kinaray-a): yahong-yahong; **Philippines** (Loo-Kankanai): napnapa, saksaklong; **Philippines** (Maeng-Itneg): kapikap, pam-upuseg; **Philippines** (Maranaw): tangila a lopa; **Philippines** (Masadiit-Itneg): kapikap; **Philippines** (Mt. Pinatubo-Sambal): tulin-bakulaw; **Philippines** (Sagada-Kankanai): sigsiggang, sipsipping; **Philippines** (Subanon): panggawa; **Philippines** (Tagalog): takip-kohol, takip-suso, taingang-daga, tapingandaga; **Philippines** (Tinglayan-Kalingga): lidlidoy; **Philippines** (Waray): yahong-yahong; **Réunion** (local): Cochléaria du pays, Coquelariat, Coq claria, Coq laria, Clocaria, Cocléria, Cocaria, Violette marron; **Rwanda** (Kinyarwanda): gutwikumwe; **Samoa** (Samoan): togotogo; **São Tomé and Príncipe** (Portuguese Creole): folha viola; **São Tomé and Príncipe** (STP): olha d'atô; **Senegal** (Diola): lèv; **Seychelles** (French Creole): villaque, bévillaque; **Sierra Leone** (Yalunka): nyeretul-la; **South Africa** (Afrikaans): paardevoet, varkoortjies, waternael, waternavel, wild violet, winternael; **South Africa** (Sesotho): bolila-balinku; **South Africa** (Tshivenda/Venda): mukulungwane, tshiha-mwando, sekeketsane, vikehecana; **South Africa** (Xhosa): iphuzi, udingu, inyongo, inyonqwana, nongobozana, nongotyazana, inyongwane, unonyongwana, unonyongwane; **South Africa** (Zulu): icudwane, isixhubho samazinyo, leauwdwane, umamgobozane, umuthi wamazinyo, unonyongwana; **South Korea** (Jeju): byeongpung namul; **South Korea** (Korean): 병풀 (byeong pul); **Sri Lanka** (Sinhala): ගඟොඵ කඟොළ (gotu kola), hin-gotukola, mandukaparni, vallaria; **Sweden** (Swedish): sallatsspikblad; **Tahiti** (unspecified): tohetupou; **Taiwan** (Hakka/Indigenous): 蘭布德胡 (ranbudehu), 含殼草 (hán ké cǎo); Taiwan (Mandarin): 含殼草 (hán ké cǎo), 蚶殼仔草, 雷公根 (léi gōng gēn), 蚶殼草, 崩大碗 (bēng dà wǎn), 落得打 (luò dé dǎ), 積雪草 (jī xuě cǎo), 地棠草 (dì táng cǎo), 蚋仔草 (ruì zǐ cǎo), 老公根 (lǎo gōng gēn); **Tanzania** (Haya): mbatama, kutikwimo; **Thailand** (Thai): bai bua bok, bua bok, buabok, chuy po co la do, บัวบก (bua bok), phak nok/phaknok; **Tonga** (local): tono; **Tonga** (Polynesian): tono; **Tonga** (Tongan): tono'itahi; **Turkey** (Turkish): asya sutasi; **Uganda** (Luganda): kutukumu, mbutamu; **Uganda** (Rutooro): embutami; **United States** (Hawaii): pohe kula; **Vietnam** (Vietnamese): cây rau má, liền tiền tháo, phác chèn, rau má, rau răm; **Wa** (Khaox/Saux): rib yhaok siyawng ([rīb hyaog si yōng] /rị̀p jʰaɔk s.jə̀ŋ/).

Conservation value:

Least Concern - LC (IUCN, 2025)

Distribution:

Centella asiatica is native to a broad area spanning the Old World's subtropical and tropical regions, including the Caucasus, tropical and subtropical Africa, Asia, eastern Australia, and the western Pacific. Its introduction beyond the native range includes Colombia, Florida, and islands such as Ascension, Bermuda, the Chagos Archipelago, Seychelles, Hawaii, the Cook Islands, the Marquesas, Niue, Norfolk Island, the Society Islands, St Helena, Tristan da Cunha, and Tubuai Islands (POWO, 2025).

Habitat:

Centella asiatica occurs in grassland, especially along riverbanks, chiefly on cultivated land (Cook, 1996a). It is found in ponds and stream banks, evergreen forests, arable land, or as a ruderal in gardens (Hedge and Lamond, 1992). *Centella asiatica* is also recorded in shaded, wet, grassy places, and river margins, at an altitude of 200–1,900 m a.s.l. (eFloras, 2008).

Invasiveness: -

Ethnobotany:

Cultural and traditional uses: *Centella asiatica* is known among many peoples as a health-promoting food source, including in many regions of Africa. In South Africa, the cooked leaves of this plant are a traditional food ingredient among the Vhavenḓa and Basotho peoples (Moteetee and Van Wyk, 2006; Magwede et al., 2019; Moteetee et al., 2019). *Centella asiatica* is widely recognised by many ethnic groups for its nutritional value in tropical West Africa. In

these regions, its leaves are eaten as vegetables and form part of the daily diet (Burkill, 1985).

A more varied use of *Centella asiatica* as a food source can be observed across Asia. It is often cultivated in Indian home gardens as a vegetable. The leaves of this species are consumed fresh or dried, often mixed with milk. Besides providing nutrients, this preparation is said to aid digestion and improve memory (Chopra et al., 1933; Nadkarni, 1954; Vulf and Maleeva, 1969). Similarly, among rural communities in northern Bengal, dishes made from this plant are known to relieve fatigue, improve digestion, treat anaemia, and enhance skin appearance (Das et al., 2006). In Sri Lanka, this plant, known as gotu kola, is commonly added to breakfast porridge, soups, and salads (Waisundara, 2019). In Bangladesh, it is valued as an ingredient in chutneys (Chowdhury et al., 1996). In Indonesia, the Sundanese and Javanese consume *Centella asiatica* raw in *lalapan*, a vegetable salad with sambal sauce. It is consumed similarly on the Malay Peninsula by Javanese–Malay communities (Sulaini and Sabran, 2018). It is also an ingredient in traditional Javanese dishes such as *pecel* and *karedok*. Sometimes, the species is deliberately cultivated along rice-field margins, where it serves both as a soil stabiliser and a source of food (De Clercq, 1909; Badrunasar and Santoso, 2016; Hernawati et al., 2022). *Centella asiatica* is an important vegetable in northern Laos, especially in the provinces of Phongsaly and Oudomxay, where it is traditionally harvested by women and older people and then sold at rural markets (Douangboupha and Sommany, 2012). In Thailand, it is a common ingredient in herbal infusions and salads, which are said to have rejuvenating properties (Salguero, 2003; Waisundara, 2019).

Centella-based drinks are also known in Vietnam, where the herb is a common ingredient in herbal infusions or is drunk as freshly squeezed juice (Vo Van Chi, 1991). The practice of drinking *Centella* juice is also common in Myanmar (DeFilipps and Krupnick, 2018). In southern China, in rural areas of Guangdong and Hainan, Cantonese families drink a health-promoting beverage made from boiled *Centella* in a mild herbal tea. In the past, this drink was sold in specialised tea shops (Science Press, 1958). On Jeju Island, South Korea, the leaves of this plant are added to *namul*, a side dish made from spiced wild herbs (Kim et al., 2015).

Centella asiatica has also found its way into the cuisine of both the Americas. In the metropolitan region of Porto Alegre, Brazil, it is classified as an 'unconventional edible plant' (PANC—*Plantas Alimentícias Não Convencionais*). It is valued there for its high protein and mineral content, and is often used as an additive to nutritional drinks (Kinupp, 2007).

Regarding its use in traditional medicine, *Centella asiatica* is known throughout the African continent as a remedy in dermatological care. It has a dual function, being used for both medicinal and cosmetic purposes. According to reports from Mahajanga in Madagascar, women traditionally apply a decoction of crushed fresh or dried leaves directly to the skin. Once dry, the application is said to promote skin regeneration. Macerations of the leaves in sunflower oil are also used for similar purposes. In addition to skin care, these preparations are also used as hair conditioners (Ranarijaona et al., 2012). Furthermore, the plant has a long-standing reputation as a remedy for leprosy, with infusions used both externally and internally. According to recipes, such an infusion is prepared from approximately 5 g of the whole plant (Debray, 1975; Boiteau, 1986). Similarly, on Réunion, a decoction of the leaves is used to treat a number of inflammatory and dermatological conditions. The crushed leaves are used externally to treat eczema, scurf patches, and abscesses. Baths made from decoctions of the plant are used for dermatoses, haemorrhoids, and varicose veins. Decoctions are also used to prepare mouthwashes for the treatment of gingivitis and ulcers. Gargling with this remedy is said to relieve sore throats and tonsillitis (Lavergne and Véra, 1989). In nearby Mauritius, baths in a decoction of the plant are also a popular remedy for skin

conditions, mainly for itchy rashes, and are continued until the itching subsides (Mahomoodally, 2014). For example, in southern Uganda, an infusion of the leaves is taken internally to treat dermatitis (Ssegawa and Kasenene, 2007). The plant is also used in Ethiopia in traditions related to the treatment of dermatological conditions. The Amhara people of the Zegie Peninsula apply a paste made from the leaves directly to swellings, while in South Omo, the Kure and Bitsmal peoples apply juice squeezed from the plant directly to affected skin (Teklehaymanot and Giday, 2007; Giday et al., 2009; Bejigo, 2024). Another traditional application in South African ethnomedicine for the treatment of skin conditions is the use of the plant as a venotonic and anti-scarring agent, with additional applications in the treatment of acne and allergic skin reactions (van Wyk, 2008). In tropical Africa, the juice extracted from the leaves is more commonly applied to the ears or skin to treat diseases of the skin and mucous membranes (Burkill, 1985).

The widespread use of *Centella asiatica* in dermatology is found throughout the plant's native range. On the Asian continent, the plant has been prized for centuries as a first-aid herb that promotes skin regeneration. This applies not only to local folk knowledge but also to classical healing systems. In Thailand, where the herb is known for its anti-inflammatory and cooling properties, it is common practice to apply crushed fresh leaves directly to burns and open wounds (Salguero, 2003). Similarly, throughout Vietnam, preparations made from freshly squeezed juice or crushed leaves are used to treat wounds, burns, acne, and various skin rashes (Vo Van Chi, 1991). In Myanmar, the plant is also used to treat wounds, ulcers, rashes, and leprosy (DeFilipps and Krupnick, 2018). In northern Luzon, Philippines, only the juice from the leaves is applied to ordinary sclerosed wounds, while decoctions of the young roots are used for infectious lesions. Mechanical injuries are treated with a plant purée, boils with pulp compresses, and chronic wounds and ulcers with daily leaf dressings (Ministerio de la Protección Social, 2008; Co, 2011).

The plant is also used throughout India. In the past, in southern India, along the Malabar coast, fresh leaves of *Centella asiatica* were harvested in large quantities, chopped, and processed into poultices, powders, and syrups, which were then used to treat ulcers, eczema, syphilitic ulcers, and leprosy. The production of such medicines was particularly popular in coastal regions, where high humidity led to greater exposure to chronic infections, which in turn increased the demand for plant-based antiseptics (Chopra et al., 1933; Nadkarni, 1954). In Nepal, in addition to the above skin conditions, the plant is also used to treat skin allergies (Bhattarai and Khadka, 2016; Miya et al., 2021). Healing baths with plant decoctions, known in African countries, are also reported in Taiwan (Chang, 2007). According to traditional Chinese medicine, decoctions and compresses of *Centella asiatica* should be used

to treat carbuncles, physical injuries, and various ulcers (Teschke et al., 2015; Li and Wu, 2017). Beyond these cases, there are reports of this species being used to treat general skin problems in Java and Bangladesh (Rahman et al., 2010; Badrunasar and Santoso, 2016; Hernawati et al., 2022).

In South America, *Centella asiatica* has also become culturally established as a plant with skin-regenerating properties. This herb is mainly used in Colombia and Brazil, where it is known as a remedy for sclerotic wounds, infected lesions, and chronic skin inflammation. For this purpose, practitioners mainly use a decoction of young roots to treat infections, or an infusion of the whole plant to wash skin lesions (Ministerio de la Protección Social, 2008; Akbar, 2020).

Another group of ailments traditionally treated with *Centella asiatica* across different latitudes includes digestive and urinary tract disorders. In Rwanda, a decoction obtained by boiling the plant with *Melanthera scandens* herb and oil is a popular remedy for dysentery (Munyaneza and Bigendako, 2008). In addition, traditional Rwandan healers recognise *Centella asiatica* as a hepatoprotective agent (Mukazayire et al., 2011). In Ethiopia, among the Kure and Bitsmal ethnic groups in the southern Omo zone, gastritis is treated with a traditionally prepared filtrate from the leaves and stems of the plant (Bejigo, 2024). Across tropical Africa, preparations from the whole plant are used to treat digestive and kidney disorders, including diarrhoea and dysentery, and to promote diuresis (Burkill, 1985).

Across Asia, similar practices and applications are reported. In Assam, India, preparations made from the leaves are taken internally to treat amoebic dysentery, and to support liver function (Sharma and Pegu, 2011). In Vietnam, infusions and juices prepared from this plant are commonly used to treat dysentery, diarrhoea, jaundice, hepatitis, and sore throat. It is also reported that this plant 'cools the body' (a traditional Chinese medicine concept of reducing excess internal heat) by removing excess

heat from the liver and digestive tract (Vo Van Chi, 1991). The above conditions are also treated with *Centella asiatica* in Taiwan, where decoctions prepared from 40–75 g of fresh plant material are used to treat abdominal complaints and diarrhoea. In the case of jaundice, a milder remedy prepared from 40 g of fresh plant material with added sugar is used (Chang, 2007). According to traditional Cantonese medicine in China, cooling teas made from *Centella asiatica* are used to treat enteritis and 'damp-heat jaundice' (a TCM diagnosis associated with pathogenic heat and moisture) (Science Press, 1958; Li and Wu, 2017). The plant is also used in a similar way to treat gastrointestinal disorders in Myanmar, Bangladesh, Nepal, and Java (Chowdhury et al., 1996; Rahman et al., 2010; Badrunasar and Santoso, 2016; DeFilipps and Krupnick, 2018; Miya et al., 2021).

In India, and especially in Bengal, it is popular to chew fresh *Centella asiatica* leaves on an empty stomach. This is intended to alleviate the symptoms of peptic ulcers and hyperacidity. In addition, a paste made from the plant and boiled in milk is used there as a liver-cleansing tonic (Nadkarni, 1954; Das et al., 2006; Chowdhury and Das, 2015; Akbar, 2020). On the island of Luzon in the Philippines, decoctions of the plant are used to treat jaundice and acute infectious hepatitis. For this purpose, 120 g of fresh herb is used for adults, and 60 g for children; the herb is boiled in 500 ml of water until the volume of the decoction is reduced to 250 ml. When the decoction is hot, 60 g of sugar is added (Co, 2011).

Notably, the use of *Centella asiatica* for digestive disorders is reported as far away as Colombia, where the plant is known as a remedy for gastritis (Ministerio de la Protección Social, 2008).

Centella asiatica is more widely used in the treatment of urinary tract disorders in Asia than in Africa. Preparations are used for inflammation, painful urination, kidney stones, and haematuria. The traditional use for these conditions is recorded in the herbal practices of countries such as Vietnam (Vo Van Chi, 1991), Taiwan (Chang, 2007), and Myanmar (DeFilipps and Krupnick, 2018). In other regions of Asia, this species is primarily valued as a remedy for kidney stones. On Luzon in the Philippines, kidney stone remedies use either 30 g of dried *Centella asiatica* boiled with rice or 30–50 g of fresh *Centella* combined with *Plantago major* and *Lygodium japonicum* (Co, 2011). Traditional Kaviraji healers from the sub-Himalayan region of India, and several ethnic groups in Nepal, use the plant's juice mixed with sugar cane molasses to treat kidney stones (Chowdhury and Das, 2015; Miya et al., 2021). In traditional Chinese medicine, *Centella asiatica* is administered as an effective remedy for the treatment of conditions such as 'stony strangury' and 'blood strangury', terms corresponding to kidney stones and bloody urination (Teschke et al., 2015).

Across regions, the plant is used for general inflammatory conditions causing fever and pain. In African countries, *Centella asiatica* is often used to treat fever, malaria, and other infectious diseases (Moshi et al., 2009). For example, among the Kwale people of Kenya, the plant is used to make decoctions, infusions, and extracts to combat fever and malaria (Muthaura et al., 2007). Haya healers in north-western Tanzania combine it with *Aspilia mossambicensis* in a decoction to treat malaria. The same mixture is prepared in alcohol to treat recurrent fevers. To relieve headaches immediately, freshly picked *Centella asiatica* leaves are rubbed directly onto the forehead (Moshi et al., 2009). Meanwhile, in Ethiopia, among the Kure and Bitsmal ethnic groups, a plant extract is administered orally for headaches (Bejigo, 2024). In West Africa, the root is regarded as the most potent antipyretic, and the leaf juice is used as a general analgesic, often for arthritis and rheumatism (Burkill, 1985).

The use of *Centella asiatica* in the treatment of rheumatic and musculoskeletal disorders is widespread in traditional Asian medicine. Medical practices preserved in Siddha and regional Ayurvedic systems recommend using this herb for chronic rheumatism. It is usually part of a long course of

treatment involving an infusion of the plant with other anti-inflammatory herbs (Nadkarni, 1954). In Thailand, infusions of this plant are consumed prophylactically by the elderly. This practice is intended to help maintain joint flexibility, and possibly to prevent inflammation-related pain (Salguero, 2003). On Luzon (Philippines), farmers and manual workers alleviate musculoskeletal ailments with this herb: 3–4.5 g of powdered leaves are taken in warm water, three times daily (Co, 2011). An illustrative example from Myanmar concerns joint cysts: an ointment is prepared by mixing plant juice with kerosene, then applied topically to the joints (DeFilipps and Krupnick, 2018). Similar practices are reported in Australia, where the Yaegl Aboriginal community in New South Wales traditionally uses the plant to treat arthritis (Williams et al., 2013).

Because it is a general anti-inflammatory, *C. asiatica* is also employed to treat various infection-related conditions. Traditional healers in Bujumbura, Burundi, use *C. asiatica* to treat ear infections by instilling a macerate into the ears, and administering steam inhalation for the respiratory tract. For this practice, the leaves are first heated in ashes, and the vapours are inhaled as a remedy for respiratory ailments and skin infections. The macerate from the leaves is also sometimes mixed with traditional beer and consumed to support the treatment of systemic infections (Ngezahayo et al., 2015). In Thailand, Vietnam, and Taiwan, infusions or decoctions of the leaves are a popular remedy for general fever. They are therefore often used preventively, especially during hot, humid seasons, and during epidemics (Vo Van Chi, 1991; Salguero, 2003; Chang, 2007). In the Philippines, a traditional remedy for tonsillitis is to slowly swallow leaf juice mixed with vinegar, which is said to soothe throat inflammation (Co, 2011). In Myanmar, a paste made from the leaves is applied to the chest in cases of respiratory tract infections (DeFilipps and Krupnick, 2018). According to documented reports, the plant is also used as an antipyretic for infections in the Philippines, Bengal, Myanmar, and Nepal, where it is particularly valued in childcare (Co, 2011; Chowdhury and Das, 2015; DeFilipps and Krupnick, 2018; Miya et al. 2021). A similar situation is reported in Polynesian island societies, such as Tonga, Samoa, and Niue. Here, the plant is primarily associated with infant care. In this context, in addition to preventing infections, delicate infusions from the leaves are applied externally to treat slow-healing navels or open fontanelles (Weiner, 1970; Whistler, 1991).

Centella asiatica is also known for its importance in traditional reproductive medicine. Among the Bamileke community in Cameroon, herbal mixtures containing this species are administered as decoctions consumed by women suffering from infertility to alleviate related gynaecological disorders (Telefo et al., 2011). Meanwhile, the Sheko people of Ethiopia apply crushed leaves topically to treat genital infections (Giday et al., 2010). Furthermore, traditional medicine practitioners in West Africa consider this species to be helpful in regulating reproductive physiology. It is believed to promote lactation, and to support and regulate sexual and reproductive vitality (Burkill, 1985). Throughout Asia, *Centella asiatica* is valued primarily for the treatment of menstrual and postpartum disorders. In Thailand, the plant is also employed to treat sexually transmitted diseases and other female reproductive disorders, including uterine cancer (Salguero, 2003). In India, the plant is valued for its regulatory effect on the female reproductive cycle. The species is used in Ayurvedic medicine as an ingredient in formulations such as Brahmi Ghritam and Rasayanam, which are primarily employed for amenorrhoea, leucorrhoea, and postpartum recovery (Nadkarni, 1954; Chowdhury and Das, 2015; Akbar, 2020).

In African traditions, *Centella asiatica* has also gained importance as a systemic tonic (van Wyk, 2008). In West Africa, preparations containing this plant are traditionally classified as tonics and sedatives. Reports indicate that their use promotes

both vascular and brain health (Burkill, 1985). A similar situation is found in South and Southeast Asia, where *Centella asiatica* is known as a brain tonic and nervine. Among African communities, it is often described as a remedy for cognitive impairment, emotional instability, and neurodegenerative conditions. For example, among the Tharu people living in regions along the Indo-Nepal border, a syrup made by macerating fresh flowers of the plant in sugar water is recognised as a traditional remedy for 'mental weakness' and memory loss (Vakshasya and Dixit, 2020). In Ayurvedic and Siddha medicine in India, *Centella asiatica* is valued as one of the four nootropic herbs Medhya Rasayana, which is said to have a rejuvenating effect on the mind. It is used to improve memory, concentration, and cognitive clarity. In addition, it is recognised as an effective medicine to support the treatment of conditions such as epilepsy, schizophrenia, mental exhaustion, and states traditionally referred to as madness or insanity (Nadkarni, 1954; Belwal et al., 2019; Waisundara, 2019; Akbar, 2020). Similarly, in Thailand, infusions made from the leaves of this plant are recognised as agents that reduce agitation and improve concentration. They are therefore used in cases of memory impairment and diseases such as Alzheimer's disease (Salguero, 2003). In Myanmar, powder from dried leaves, mixed with honey, is consumed at night to help treat insomnia. The juice from fresh leaves is mixed with sugar or honey and then taken to support mental vitality. These preparations are taken both prophylactically and therapeutically, often during periods of weakness or convalescence (DeFilipps and Krupnick, 2018). A similar situation can be found in Bangladesh, where the Tharu people of the Terai region use the plant as a nerve tonic that also aids memory (Miya et al. 2021). *Centella asiatica* has a very similar application in the Americas, where it is likewise valued as a general and cognitive tonic. In countries such as Mexico, Venezuela, and Brazil, this species is an ingredient in medicines designed to improve memory (Weiner, 1970; Akbar, 2020).

Other conditions traditionally treated with *Centella asiatica* include disorders of the circulatory system. These conditions are treated with the plant mainly in Asian countries. Traditional Thai medicine presents decoctions of the plant as 'improving blood quality' while also lowering blood pressure (Salguero, 2003; Chang, 2007). In Malaysia, simply consuming the plant in meals is considered beneficial for regulating blood pressure (Sulaini and Sabran, 2018). Furthermore, practitioners of traditional Kaviraji medicine in northern Bengal and local doctors in some parts of India and Bangladesh administer the plant in cases of anaemia. In such cases, it is typically combined with foods or herbs rich in iron (Das et al., 2006; Chowdhury and Das, 2015). Among the Sundanese people of West Java, the whole plant is consumed fresh or cooked in decoctions to treat high cholesterol and conditions referred to as 'blood weakness' (Hernawati et al., 2022). The situation is very similar in the Americas. In Brazil, traditional herbalists recommend this plant for the treatment of high blood pressure and general improvement of circulatory function. It is considered not only a hypotensive agent, but also a circulatory stimulant (Akbar, 2020). In addition, both the Mexican and Venezuelan pharmacopoeias officially list *Centella asiatica* as a tonic and circulatory enhancer, classified as hypotensive, and recognised as a systemic vascular support (Weiner, 1970).

Centella asiatica has also been recognised as a detoxifying agent, or even an antidote, in traditional medicine. On the Philippine island of Luzon, the fresh juice of the plant is consumed in cases of poisoning from insufficiently processed cassava. The liquid obtained after boiling the plant with *Raphanus sativus* is consumed to treat mushroom poisoning. In the case of general food poisoning, *Centella* leaves are crushed in a mortar with the roots of *Ipomoea aquatica*, then the expressed juice is separated. This juice is mixed with boiling water, then taken to relieve symptoms (Co, 2011). Earlier publications describing customs on the Malabar

Coast in India also documented the use of the plant to alleviate the effects of snakebites (Chopra et al., 1933). In Fiji, an infusion of *Centella asiatica* leaves was used to treat poisoning from toxic reef fish species (Skottowe, 1889).

Less popular uses of *Centella asiatica* in traditional local medicine include preparing herbal eye masks and eye drops from the leaves among the people of Myanmar. This is intended to relieve eye fatigue and sensitivity to light (DeFilipps and Krupnick, 2018). In addition, the Ethiopian Bench community uses *Centella* to treat meningitis (Giday et al., 2009). Some local healers also recommend it to help regulate blood sugar levels (DeFilipps and Krupnick, 2018).

In an ethnoveterinary context, *Centella asiatica* is used specially to treat infectious diseases in domestic animals. Among herders in the southern district of Ari in Ethiopia, the remedy is prepared by pounding the leaves and stems of the plant, mixing them with water, and then administering the resulting solution intranasally. This method is used in the treatment of blackleg (*gangraena emphysematosa*) in calves, locally known as abakorpa (Kidane et al., 2014). *Centella asiatica* is also used against colibacillosis in livestock, for example in the Kivu region of the Democratic Republic of the Congo. For this purpose, the plant is first macerated with *Sida rhombifolia*, *Psidium guajava*, and *Ocimum gratissimum*. The resulting liquid is then administered orally to sick calves (Plateforme Diobass au Kivu, 2005).

In addition to its use in treating diseases in animals, *Centella asiatica* is also used to increase livestock productivity by enhancing lactation. To achieve this, the species is commonly included in cattle feed (Kidane et al., 2014; Burkill, 1985). Similarly, in Asia, the plant is added to livestock feed, where it is valued for its nutritional properties. In the southern Qinling region of China, and further south along the border with Myanmar, the plant is a popular ingredient in diets for cattle, pigs, and poultry (Watkins, 2013; Li and Wu, 2017).

Centella asiatica also serves as a natural soil stabiliser and erosion-control agent. In Java, during the time of the Dutch East Indies, this plant was widely cultivated along rice embankments and on garden slopes (De Clercq, 1909). Throughout India, the plant has long been used as a ground cover, valued for its ability to reduce surface erosion (Vulf and Maleeva, 1969).

In some cultures, *C. asiatica* also features prominently in spiritual practices. For example, among the Mising people of Assam, India, the herb, known as manimuni, is included in sacred offerings during the Ajenge Dues ritual, which is a central part of the Dobur Uie ceremony. During this ceremony, the plant is also brewed into apong, a traditional rice beer. According to local belief, its consumption is thought to provide protection against supernatural forces (Sharma and Pegu, 2011). *C. asiatica* is also used as a 'spiritual repellent' in the Rakai district of Uganda. There, crushed leaves rubbed into the body are believed to ward off 'night dancers' (Ssegawa and Kasenene, 2007). Meanwhile, among the Kure and Bitsmal peoples of southern Omo in Ethiopia, the plant is used as a remedy against the 'evil eye', an ailment caused by a jealous or malicious gaze, which, according to local belief, causes harm, illness, or misfortune. To prevent this, a filtrate from the leaves and stems is prepared and ceremonially drunk (Bejigo, 2024).

Scientific perspective *Centella asiatica* is rich in vitamins essential for the proper functioning of the body. These include vitamin A (including carotenoids), vitamin C, vitamin B1, B2, and niacin (Salguero, 2003; Waisundara, 2019). It also contains essential minerals such as potassium, calcium, magnesium, sodium, and iron, and is rich in amino acids and sugars. This supports its use as a functional food supplement for human nutritional deficiencies (Badrunasar and Santoso, 2016; Akbar, 2020).

More than 124 phytochemicals have been identified in *C. asiatica* (Torbati et al., 2021). The main bioactive substances are pentacyclic

triterpenoid saponins, often referred to as centelloids. Centelloids include glycosides such as asiaticoside and madecassoside, and aglycones (asiatic acid and madecassic acid). These triterpenes have numerous pharmacological properties, such as wound healing, neuroprotection, anti-inflammatory effects, and vascular support. These properties directly confirm the validity of many traditional uses of the plant. Other substances worth mentioning are flavonoids (quercetin, kaempferol, and rutin), essential oils (β-caryophyllene, germacrene), sterols (campesterol, stigmasterol, and sitosterol), alkaloids (hydrocotylin), polysaccharides, tannins, and polyacetylenes (Lee et al., 2019). In addition, the presence of mesoinositol, centellose, vellarine, and carotenoids further enhances the pharmacological potential of the species (Chopra et al., 1933).

In experimental studies, *C. asiatica* has shown significant efficacy in the treatment of chronic venous insufficiency and varicose veins. Extracts from *C. asiatica* enhance venous tone, reduce capillary permeability, and support lymphatic drainage. This effect has been attributed primarily to the aforementioned triterpenoids — asiaticoside and madecassoside. These substances have a protective effect on endothelial cells and the connective tissue surrounding the veins (Ministerio de la Protección Social, 2008; Torbati et al., 2021). Clinical studies also show that oral administration of the plant extract has a beneficial effect on microcirculation, simultaneously reducing blood vessel swelling in a dose-dependent manner (Akbar, 2020).

Several factors contribute to the effective anti-inflammatory action of *C. asiatica*. Triterpenes, such as asiatic acid and madecassic acid, help reduce inflammation by blocking the body's main inflammatory switch (NF-κB, a transcription factor that controls inflammatory signalling). This process reduces the production of key inflammatory mediators such as TNF-α and IL-6, and decreases the activity of COX-2, an enzyme responsible for pain and swelling. The plant's immunomodulatory potential includes the production of cytokines, stimulation

of lymphocyte proliferation, and enhancement of macrophage activity. These properties form the basis for the traditional use of the plant in the treatment of diseases and immune disorders, including arthritis (Belwal et al., 2019; Torbati et al., 2021; Williams et al., 2013).

Animal studies conducted to date confirm the hepatoprotective effect of *C. asiatica* extract. This is thought to be due to the extract's ability to regulate antioxidant enzymes (SOD, CAT, GPx) and inhibit lipid peroxidation (Belwal et al., 2019). The hepatoprotective effect of the plant described in traditional medicinal systems may be related to the richness of triterpenoid saponins, flavonoids, and phenolic acids contained in the plant, which probably also contribute to its metabolism-regulating effects (Salguero, 2003).

Studies also confirm the antiseptic effect of *C. asiatica*, showing activity against bacteria such as *Staphylococcus aureus* and fungi such as *Candida albicans*. This effect is attributed to flavonoids, tannins, essential oils, and triterpenes (Salguero, 2003).

The well-documented antioxidant properties of *C. asiatica* include activation of the Nrf2 pathway (a master regulator of antioxidant responses), increased activity of antioxidant enzymes (SOD,

catalase, glutathione peroxidase), and a reduction in the level of oxidative-stress markers such as malondialdehyde (Belwal et al., 2019; Waisundara, 2019).

Extracts from *C. asiatica* also show cytotoxicity against cancer-cell models, including lung cancer, glioblastoma multiforme, and medulloblastoma. The aforementioned asiatic acid and madecassoside play a major role in this activity, which, studies suggest, promote apoptosis and inhibit cancer-cell proliferation. This is associated, among other mechanisms, with regulation of mitochondrial membrane potential, caspase activation, and inhibition of angiogenesis pathways (Belwal et al., 2019). Notably, animal studies in rats using very high doses of plant extracts have reported a potential link to the development of skin cancer, prompting the Canadian authorities to introduce temporary precautions (Ranarijaona et al., 2012).

Nevertheless, owing to its richness in active constituents, and consequent breadth of applications, the plant is incorporated into conventional medicine and is widely used in pharmaceuticals (Waisundara, 2019). In clinical dermatology, extracts from *C. asiatica* are used to treat conditions such as slow-healing wounds, burns, postoperative scars, and chronic venous ulcers (Lee et al., 2019). In neurology and psychiatry, this plant shows benefits for conditions such as Alzheimer's disease, cognitive impairment, anxiety, and depression. These properties are attributed to its ability to regulate GABAergic pathways and its general antioxidant activity (Teixeira et al., 2016).

The European Medicines Agency (EMA) recommends the use of preparations containing 1% extract in topical creams, or 10 mg orally three times a day, for the treatment of wounds. Clinical studies have confirmed that supplementation with 500 mg of extract twice daily for two months may be effective and safe in alleviating symptoms of anxiety and stress (Jana et al., 2010)

Centipeda minima (L.) A.Braun and Asch.

Family:

Asteraceae Bercht. and J.Presl

Synonyms:

Artemisia minima L., *Cotula minima* (L.) Willd., *Dichrocephala minima* (L.) Bojer, *Grangea minima* (L.) Dum.Cours.

Vernacular names:

Australia (Aboriginal): gukwonderuk, kand-jirkalara, kanjirralaa, ntaingntainga; **Australia** (English/common): sneezeweed, spreading sneezeweed; **Bangladesh** (Bengali): hachuti; **Bengal** (Bengali): chhikni; **China** (Chinese/Gaomi): E'Bushi; **Hong Kong** (Cantonese): Ngor-but-sik-cho; **Hong Kong** (Cantonese/Traditional Chinese): 石胡荽 (shí hú suī); **India** (Assamese): hansia bon; **India** (Bodo): hansio bighang, hasut-ibon; **India** (Hindi/Dehradun region): nakh-chhikni; **India** (Hindi/Unani/Sanskrit): afkar, chhavak, chhikka, chikkani, chikkika, gawejahan, ghranaduhkhada, kshavaka, ksutkari, kundush, mecheta, nak chhikani, nakachhikni, nakachikani, nakachikini, nakachinka, nakchikni, nakehhikni, nakh-chhikni, nakshikani, narasinkani, nagdowana, tikshna; **India** (Oriya): nakchinka; **India** (Sanskrit): Chikkika, Tikshna, Ghrandukhahda, Chhikkani, Kashvakrit, Mecheta; **India** (Tamil): Manyanani; **Indonesia** (Indonesian): pecah pinggan; **Indonesia** (Javanese): mbakoan; **International** (English): centipedae herba, small centipeda, sneezeweed, sneezewort, spreading sneezeweed; **International** (Mandarin): 地胡椒 (dì hú jiāo), 鹅不食草 (é bù shí cǎo), 石胡荽 (shí hú suī), 白球子草 (bái qiú zǐ cǎo), 鸡肠草 (jī cháng cǎo), 球子草 (qiú zǐ cǎo), 沙飞草 (shā fēi cǎo), 石胡荽属 (shí hú suī shǔ), 金地罗 (Chin ti-lo), 小食草 (hsiao-shih ts'ao), 圆子草 (yuan-tzu ts'ao), 嘻嘻草 (hsi-hsi ts'ao), 大九甲 (ta-chiu chia), 野冬膏 (yeh tung kao), 冷水坛 (leng-shui-tan), 铁金花 (tieh chin-hua), e bu shi cao; **International** (Russian): стоножка малая (stonozhka malaya), стоножка округлая (stonozhka okruglaya); **Japan** (Japanese): キク科トキソウ (Kikuka Tokisō), トキンソウ (Tokinsō), タネヒリグサ (Tanehirigusa),

ハナヒリグサ (Hanahirigusa); **Korea** (Korean): 중대가리풀 (jungdae-garipul), A-bul-sik-cho; **Laos** (Khao/Saux): sidah saux sang; **Macau** (Traditional Chinese): 石胡荽 (shí hú suī); **Malaysia** (Mandarin): 鸡肠草 (jī cháng cǎo), 球子草 (qiú zǐ cǎo), 沙飞草 (shā fēi cǎo), 石胡荽 (shí hú suī), 鹅不食草 (é bù shí cǎo); **Myanmar** (Burmese): shwe thit sin; **Nepal** (Kumal/Gandharva): chhimke, jhar; **Nepal** (Nepali): chhin jhar, chhischchar jhar, chhiuke jhar, chhyun jhar, hachhyun ghyan, hachhyun jhar, nakachikini, sano; **Philippines** (Bisaya): pisik; **Philippines** (Tagalog): harangan; **Sri Lanka** (Sinhala): හීන් කිඹු (heen kimbu), විෂ චූණ්ණිය (visa chunniya), විෂඩුලී (visaduli), visa dooli; **Taiwan** (Mandarin): 石胡荽 (shí hú suī), 鹅不食草 (é bù shí cǎo), e bu shi cao; **Thailand** (central): krataai chan; **Thailand** (eastern): mueat lot; **Thailand** (peninsular): yaa krachaam; **Vietnam** (Vietnamese): cúc mẫn, cỏ the, thạch hồ tuy, nga bất thực thảo, địa hồ tiêu, câu tử thảo, cúc trăm chân, bách hài, cầu tuả thaảo, cóc mâản, cóc ngôêi, coả láng the, thuôắc mộng

Conservation value:

Least Concern - LC (IUCN, 2025)

Distribution:

Centipeda minima is native across a broad region, encompassing the Russian Far East, temperate and tropical Asia, and the South Pacific. Its native range includes areas such as Amur, Eastern Himalaya, India, China (both north-central and southeast), Japan, Southeast Asia (including Indochina and Malesia), Australia, New Zealand, and several Pacific islands. Beyond its natural distribution, the species has been introduced to parts of Europe and Africa, notably including Belgium, Germany, Liberia, Madagascar, Mauritius, and Réunion (POWO, 2025)

Habitat:

Centipeda minima is an annual plant that occurs in a broad range of habitats. It is commonly found in wet environments, such as marshy banks, shallow water, and rice fields. Additionally, it inhabits waste ground and roadsides, and can grow in almost all soil types across diverse habitats (Rehel, 2011).

Invasiveness: -

Ethnobotany:

Cultural and traditional uses: There are few reports of strictly culinary use of *Centipeda minima*. They come mainly from the Baksa district in the state of Assam in India, where the herb is part of the diet of the Assamese and Bodo communities. There, it is typically used as a wild vegetable which, after thermal processing, is added to vegetable dishes (Baro et al., 2015).

Centipeda minima is more widely used by traditional medicine practitioners. The herb is known in both Asia and Australia as a remedy for various respiratory conditions, such as cough, sinusitis, rhinitis, bronchitis, and the common cold. In Vietnam, both fresh and dried aerial parts of the

herb are used to prepare a medicinal decoction for coughs and sore throats. According to reports, the doses used range from 6–12 g for dried material, and 20–40 g for fresh material (Đỗ, 2004). Similar uses are reported across Indochina and Thailand, where this species is also known as a traditional remedy for bronchitis and colds (van Valkenburg and Bunyapraphatsara, 2001).

In Chinese medicine, preparations from *Centipeda minima* are used for various upper respiratory tract disorders, including rhinitis, sinusitis, bronchitis, and whooping cough (But et al., 2000; Lin et al., 2020). Traditional Chinese medicine considers *C. minima* to be warming, pungent, and aromatic. According to its recommendations, it can be mixed in decoctions with *Magnolia liliflora* and *Xanthium strumarium*. These decoctions are said to help treat both acute and chronic rhinitis. One well-known preparation in Chinese medicine is a nasal-drop formulation consisting of 30 g of powdered herb mixed with 70 g of glycerine. More traditional practice in China involves crushing the herb and applying it directly to the nostrils to bring quick relief (A Barefoot Doctor's Manual, 1970).

Centipeda minima has a similar use in Nepal. Ethnobotanical studies conducted among communities in Pokhara, in the Kaski district, have shown the herb to be used in the treatment of colds, sinusitis, and fever (Bastakoti, 2013). It is also used to treat these conditions in India, where regional practices vary. In the Eastern Ghats (southern Orissa), dried leaf powder is mixed with mustard oil to relieve nasal congestion. The resulting mixture is then used for inhalation (Panda and Misra, 2011). In the Doon Valley (Uttarakhand), the powder is used to induce sneezing, and to treat influenza and headaches, and even neurological disorders (Adhikari et al., 2010). Among the Bodo community in Assam, as among the Australian Alyawarra people, a paste made from the herb (mainly from the flowers) is used externally to relieve cold symptoms (Boro et al., 2023).

In Australia, Aboriginal communities, as well as historical European settlers, used decoctions

and infusions of *C. minima* to treat colds. Crushed leaves were used primarily to clear the airways. In Aboriginal and settler practices in Australia, the herb was also inhaled as a substitute for Pituri (*Duboisia hopwoodii*) or wild tobacco (*Nicotiana* spp.), which may indicate a mild stimulant effect of the herb (Cribb and Cribb, 1981; Williams, 2013; Lassak and McCarthy, 1983). In addition, the Alyawarra people of central Australia used the herb externally, rubbing it into the skin for colds and respiratory infections. For this purpose, ointments made from the herb mixed with fat were used (O'Connell et al., 1983).

The plant has a wide range of traditional applications for eye complaints. For example, it is applied topically for conjunctivitis with purulent discharge (Đỗ, 2004). Similarly, in Australia, *C. minima* has historically been recognised as a remedy for sandy blight—a historical Australian term for trachoma—and purulent eye inflammation. In colonial times, it was even sold as a 'Magic Ophthalmia Cure' (Cribb and Cribb, 1981). Botanical records by colonial explorers and botanists Thomas Mitchell and Joseph Maiden confirm the widespread use of the species by both settlers and Indigenous Australians (Williams, 2013). Notably, Aboriginal communities sometimes combined the species with other members of the *Centipeda* genus, such as *C. cunninghamii* and *C.*

thespidioides, to treat eye inflammation (Yeshi et al., 2022). The species was recorded in China, Malaysia, and India as a treatment for eye diseases. In this case, the powdered plant was taken as snuff to induce lacrimation (Burkill, 1985).

Centipeda minima is widely employed as an anti-inflammatory agent, with analgesic properties. Consequently, it is employed to manage a range of conditions. For example, in traditional Chinese medicine, decoctions of the plant are administered for conditions such as paralysis, joint pain, malaria, hepatitis, eczema, insect bites, snakebites, and even diabetes. Interestingly, when combined with wine, the plant is administered as a traditional remedy for internal injuries (van Valkenburg and Bunyapraphatsara, 2001). The anti-inflammatory effect of the plant has likewise been reported among local Indian communities. In Indian medicinal traditions, *C. minima* is applied as a paste to treat local swelling, inflammation, and toothache. Furthermore, decoctions of the plant serve as a painkiller in the treatment of joint disorders and headaches (van Valkenburg and Bunyapraphatsara, 2001; Burkill, 1985; Panda and Misra, 2011; Williams, 2013).

In Taiwan, *Centipeda* decoctions are employed in traditional practice for general digestive problems (van Valkenburg and Bunyapraphatsara, 2001). The situation is similar in Hong Kong, where the herb is employed to treat digestive ailments, including abdominal pain, diarrhoea, vomiting, and amoebiasis (But et al., 2000). Meanwhile, in Indian medicine, this plant is primarily valued for its anthelmintic properties in stomach disorders. Local physicians attribute this to its 'hot' and drying properties (Burkill, 1985; Williams, 2013).

There are no documented ethnoveterinary uses. Moreover, there are reports from northern Australia linking the consumption of *Centipeda minima* to livestock poisoning. However, details of its effects on animals require further research (van Valkenburg and Bunyapraphatsara, 2001).

Scientific perspective: Currently, there is no information available on the nutritional properties of *Centipeda minima*. The cultural significance of the plant is mainly related to its high content of phytochemicals, which are used in traditional folk medicine. Previous studies have identified over 100 secondary metabolites in *C. minima*, among which sesquiterpene lactones predominate. These include compounds such as brevilin A, helenalin derivatives, florilenalin, and various plenolin esters—specifically 6-O-methylacrylylplenolin, 6-O-angeloylplenolin, and 6-O-isobutyroylplenolin (But et al., 2000; van Valkenburg and Bunyapraphatsara, 2001). The plant also contains numerous flavonoids, including quercetin, quercetin-3-methyl ether, quercetin-3,3'-dimethyl ether, kaempferol-7-rhamnoside, and apigenin, which are known for their antioxidant and anti-inflammatory properties (Yeshi et al., 2022). Various triterpenes and their glycosides have also been reported in the plant. These include taraxasterol, arnidiol, lupeol, taraxerol, lupeyl acetate, and the glycosides of ursolic and oleanolic acid (Đỗ, 2004). The plant also contains steroidal components, such as stigmasterol, campesterol, and β-sitosterol, as well as volatile compounds, including α-pinene, β-pinene, myriogynic acid, and palmitic acid. In addition, the plant contains aurantiamide acetate, thymol-like constituents, methoxystilbenes, hexacosanol, and various tannins and astringents (Burkill, 1985; But et al., 2000).

Pharmacological studies conducted to date on extracts from *Centipeda minima* have demonstrated diverse pharmacological potential. Methanol extracts have been found to inhibit farnesyl protein transferase (FPTase), which suggests antiproliferative, or even anticancer, properties in this plant (Nandi et al., 2023). Water extracts containing brevilin A have shown antiparasitic activity: they effectively combat *Entamoeba histolytica*, a protozoan that causes amoebiasis, and *Plasmodium falciparum*, another protozoan that causes the most severe form of malaria in humans. In addition, ethyl acetate extracts show significant cytotoxicity against HeLa S3 human cervical cancer cells, with $IC_{50} < 10$ μg ml^{-1} under the reported conditions (van Valkenburg and

Bunyapraphatsara, 2001). The traditional therapeutic properties associated with the treatment of the upper respiratory tract are primarily attributed to essential oils containing bitter sesquiterpene acids, such as myriogynin and myriogynic acid (Burkill, 1985).

The most thoroughly researched properties of the plant include its anti-inflammatory effects. Some natural compounds, such as brevilin A, apigenin, aurantiamide acetate, and quercetin derivatives, are involved in reducing the production of key pro-inflammatory cytokines, such as IL-1β, IL-6, and TNF-α. They also modulate the levels of other immune system mediators, such as IL-10 and TGF-β, which have an inhibitory effect on inflammatory processes. In addition, these substances limit enzymes such as nitric oxide synthase (iNOS) and cyclooxygenase (COX-1 and COX-2), which are responsible for the production of molecules that exacerbate inflammation and pain, such as prostaglandins (Yeshi et al., 2022). Furthermore, according to research, the sesquiterpene lactones contained in the plant have been shown to be effective against *Staphylococcus aureus* (implicated in skin inflammation) and *Bacillus subtilis* ("hay bacillus") (But et al., 2000; van Valkenburg and Bunyapraphatsara, 2001). The antiviral efficacy of the plant has been supported by in vitro inhibition of herpes simplex virus, poliovirus, and Sindbis virus after the application of its methanol extracts (But et al., 2000). The antiallergic and antihistaminic effects of the plant have also been reported, including inhibition of histamine release and disruption of platelet-activating factor (PAF) binding (Yeshi et al., 2022).

Brevilin A, contained in *Centipeda minima*, appears to be the main agent responsible for the activity against both blood-borne and intestinal parasites (But et al., 2000; van Valkenburg and Bunyapraphatsara, 2001). Despite the traditional use of the plant in Chinese medicine for its hepatoprotective and detoxifying properties, there is currently no scientific evidence supporting these claims. Nevertheless, these properties are likely due to the presence of triterpenes and flavonoids with known hepatoprotective potential (Yeshi et al., 2022).

Ceratopteris thalictroides (L.) Brongn.

Family:

Pteridaceae E.D.M.Kirchn.

Synonyms:

Acrostichum thalictroides L., *Furcaria thalictroides* (L.) Desv., *Pteris thalictroides* (L.) Sw., *Teleozoma thalictroides* (L.) R.Br.

Vernacular names:

Belgium (Vlaams): watervaren; **Cape Verde** (Crioulo): feto d'água; **China** (Hani/Honghe Prefecture): nuo nuo cai; **China** (Min Bei): wu ma jue; **China** (Wú): shui jue; **China** (Yue): wu mao jue, long chuan jue; **Czech Republic** (Czech): rohatec žlutěuchový, obšírák žluťuchovitý; **Finland** (Finnish): riisisaniaiinen; **Guam** (Chamorro): Umug sensonyan; **India** (English): water sprite; **India** (Sanskrit/Indian languages): jatakushi; **Indonesia** (Dayak communities/Central Kalimantan): bajei; **Indonesia** (Indonesian): pakurioh, pakis rawa, paku tespong, paku cai, paku rawa; **International** (Arabic): حبش الماء (shabah al-ma'), سرخس الماء (sarkhas al-ma'), سرخس الماء الشرقي (sarkhas al-ma' al-sharqi), سرخس هندي (sarkhas hindi), سرخس القرن المائي (sarkhas al-qarn al-ma'i), سرخس القرن (sarkhas al-qarn), سرخس قرن الوعل (sarkhas qarn al-wa'el); **International** (English): antler fern, horn fern, Indian fern, meadowrue-like ceratopteris, oriental water fern, pod fern, swamp fern, Sumatra fern, water fern, water horn fern, water sprite, floating stag's-horn fern; **International** (French): fougère de Sumatra, fougère aquatique flottante, fougère filigrane; **International** (German): Wasserhornfarn; **International** (Italian): felce acquatica cornuta, felce indiana; **International** (Mandarin): 水蕨 (shuǐ jué), 水松草 (shuǐ sōng cǎo); **International** (Portuguese): feto aquático, muururé,

samambaia-d'água; **International** (Russian): Цератоптерис василисниковидный (Tseratopteris vasilisnikovidnyi), папоротник индийский водяной; **International** (Spanish): helecho de Sumatra, helecho acuático de los trópicos; **Iraq** (Arabic): el-khenshar almaee, عوطقم الصأل (magtu' al asel); **Israel** (Hebrew): sarach hamami; **Japan** (Japanese): ミズワラビ (mizu-warabi), mizu-ninjin, mizu-bōfu; **Korea** (Korean): 물고사리 (mul-go-sa-ri); **Laos** (Lao): kok karn pu; **Malaysia** (Malay): paku roman, paku ruan, sayur kodok, pakis-rawa, sajor-kodok; **Nepal** (local communities/Kanchanpur District): Unui; **Nepal** (Nepali): unyun; **North Macedonia** (Macedonian): dnana paprat; **Palau** (Palauan): tielauek; **Pakistan/India** (Urdu): pani ka fern; **Peru** (Spanish): helecho de Sumatra; **Philippines** (Filipino): pakong-ro-man; **Philippines** (Hanunoo): banawug sapat; **Philippines** (Ifugao): bakkaku; **Philippines** (Maranao): pako a paletaw; **Philippines** (Sambal, Botolan): pako buaya; **Philippines** (Tagalog): pakong-sungay, makahirak-hirak, pakong tubig, saguaray; **Poland** (Polish): paproć wodna, różdżyca rutewkowat, tysiącliść; **South Africa** (Afrikaans): watervaring; **Sri Lanka** (Sinhala): පිලිහුඩුපලා (pilihudu pala); **Sri Lanka** (Sinhalese/Kandy): Deyahena; **Sweden** (Swedish): smal vattenbraken, smalbladig flytormbunke, sumatraormbunke; **Taiwan** (Chinese): 水蕨 (shuǐ jué); **Thailand** (Thai): phak khaakihat, phak kuutnam, phak kuut kao kwuang, กูดเขากวางน้ำ (kud khao kwang nam); **Thailand/Laos/Vietnam/China** (Hmong Daw): kaus suab; **Turkey** (Turkish): boynuz eğrelti, boynuz eğreltişi, su eğreltişi; **United Kingdom/USA** (English): water fern, water sprite, floating stag's-horn fern, pod fern, oriental water fern; **United States** (Hawaiian): hihi-awai; **Vietnam** (K'Ho): Biệp crồng; **Vietnam** (Vietnamese): ráng gạc nai, quyết gạc nai, rau cần trôi, ráng gạt nai.

Conservation value:

Least Concern - LC (IUCN, 2025)

Distribution:

Ceratopteris thalictroides is native to tropical and subtropical regions worldwide, including large parts of Africa, Asia, Australia, and the Americas. Its native range encompasses countries such as Angola, Kenya, India, China, Japan, Australia, Brazil, and the United States (Florida, California, Texas), as well as numerous island groups across the Pacific and Indian Oceans. Beyond its native range, *Ceratopteris thalictroides* has been introduced to parts of Europe (Austria, Romania), and Pacific islands such as Fiji and Hawaii (POWO, 2025).

Habitat:

Ceratopteris thalictroides is an aquatic fern of paddy fields and other open wetlands, common at low to medium elevations throughout Thailand. This taxon is becoming rarer in areas where herbicides are used, as in much of Japan. It is feared that it will suffer similar damage in Thailand in the near future (Lindsay and Middleton, 2012). This species occurs in semi-shaded wetlands, mostly rooted in mud, occasionally free-floating, and is common in paddy fields and ponds (Manickam and Irudayaraj, 1992; Nair et al., 1992; Nayar and Geevarghese, 1993; Mahesh, 2010).

Invasiveness:

It is considered invasive in some warm, humid regions like Western Australia and central/southern Florida (Vélez-Gavilán, 2022)

Ethnobotany:

Cultural and traditional uses: *Ceratopteris thalictroides* is a fern commonly used as a green vegetable in tropical regions of Asia, Oceania, and parts of Africa. Its young above-ground parts are commonly harvested from wild or semi-cultivated wetlands. In Central Kalimantan, Indonesia, this plant is eaten raw or cooked by members of the Dayak community. Its popularity is evident from its sale in local markets, and it is valued primarily for its nutritional content. According to reports, it is recommended for pregnant women to help strengthen the body (Chotimah et al., 2013). The species is also popular among other communities inhabiting the Indian subcontinent. It is likewise consumed as a green vegetable in the Indian state of Odisha (Behera et al., 2022; Hindlekar et al., 2022), West Bengal, and Tamil Nadu (Sen and Ghosh, 2011; Al-Snafi, 2018), and in the Satpura Range in Madhya Pradesh (Singh and Upadhyay, 2014). Outside India, it is consumed similarly in Vietnam; for example, by the K'Ho ethnic group living near Bidoup–Nui Ba National Park (Huong et al., 2021). In Nepal, this species is valued as a food source during periods of shortage. In western Chitwan, *C. thalictroides* is collected from wetlands and consumed with other aquatic plants by the Tharu and Darai peoples, as well as migrant mountain communities (Dangol, 2008). In Kanchanpur District, this plant is also used in everyday cooking (Bhatt and Kunwar, 2020).

In its raw form, the plant is eaten as a salad ingredient in Micronesia (Joshi et al., 2019), and, historically, in Guam (Safford and Safford, 1905). According to recent reports, this practice is still common throughout the Malay Archipelago (Joshi et al., 2019). The species is also known as a food source in Hawaii, where it was harvested from taro fields (Aikau, 2012). In Malaysia, Japan, and the Philippines, young to mature leaves are eaten raw in salads, or consumed after blanching. In these countries, they are often considered a delicacy, valued for their subtle flavour and tender texture (Grubben and Denton, 2004). In Japan, the plant is known as *mizu-warabi* (ミズワラビ), meaning 'water fern' (Safford and Safford, 1905). In southern China, among the Hani people, *C. thalictroides* is usually stewed with pork or boiled in broth (Luo et al., 2019).

In West Africa, it is used sporadically. Among the Mende and Temne communities living in Sierra Leone, its leaves are eaten as a vegetable, as in the regions mentioned above. However, it has been noted that along the coast, this fern is sometimes cultivated as a crop (Burkill, 1985). Meanwhile, in Madagascar, this fern is consumed in dishes as a substitute for watercress (Grubben and Denton, 2004).

Historically, during World War II, *C. thalictroides* was known among troops stationed in the Pacific region as a source of emergency food. Notably, botanist Elmer Drew Merrill recommended it as an emergency food in life-threatening situations, due to its abundance and edibility (Sumner, 2019).

Beyond its wide culinary uses, *Ceratopteris thalictroides* is traditionally used throughout the Indian subcontinent to treat wounds, an effect attributed to its recognised haemostatic properties. In the state of Odisha, fresh juice is applied directly to wounds to stop bleeding (Behera et al., 2022; Woldeamanel et al., 2022). In the Satpura Mountains of Madhya Pradesh, fresh leaves are applied to open wounds for haemostasis (Singh and Upadhyay, 2014). Similarly, leaves are used as poultices in Tamil Nadu and Arunachal Pradesh (Jain and Rao, 1983; Benniamin, 2011; Karthik et al., 2011). Plant pastes are used for the same purpose, for example among mountain communities of the Kumaun Himalayas (Joshi et al., 2019). In Assam, turmeric is added to the plant mixture to enhance its effect (Barukial and Sarmah, 2011). This practice is likewise reported among some central Indian communities, such as the

Chenchu, where powdered leaves of *C. thalictroides* are mixed with turmeric and applied to unhealed wounds (Saroya, 2017; Al-Snafi, 2018). The plant's ability to promote skin healing underpins its use in the treatment of dermatological conditions. Leaves of *C. thalictroides* are traditionally used throughout India as poultices for such ailments (Barukial and Sarmah, 2011; Benniamin, 2011; Karthik et al., 2011; Singh and Upadhyay, 2014; Behera et al., 2022). Comparable practices are reported across the region, including in Nepal (e.g., Kanchanpur), Malaysia and the Philippines (where leaves and roots are used for skin infections and carbuncles), China (where compresses are regarded as drawing agents for pustular eruptions), and in West Asia, such as Iraq (Al-Rawi and Chakravarty, 1964; Grubben and Denton, 2004; Bhatt and Kunwar, 2020).

Because this plant is widely recognised for its general anti-inflammatory properties, its use extends to other ailments. In Chinese and Indian medicine, in addition to treating wounds and skin conditions, it is traditionally believed to reduce swelling, support detoxification, and treat fever, dysentery, injuries, and even epilepsy (Ye, 2017). The Kurava and Irula peoples in Tamil Nadu use the leaves of this plant to treat dysentery (Arulappan et al., 2015). On the Andaman and Nicobar Islands, the plant is valued for its general strengthening properties. Consequently, leaf-based decoctions and baths are used for newborns and for mothers after childbirth, and are said to relieve post-partum abdominal swelling (Kamble et al., 2008).

Beyond its culinary and medicinal uses, across several parts of South-east Asia, including Malaysia and Japan, this fern is used as a green fertiliser in rice fields; after rapid growth, it is ploughed into the soil to increase soil fertility (Grubben and Denton, 2004). The plant has a similar role in Sierra Leone, West Africa, where it is used as a soil-enriching compost material (Burkill, 1985). This fern also has ornamental value. Owing to its specific habitat requirements and attractive leaf shape, it is sometimes cultivated as an ornamental plant in aquaria (Behera et al., 2022). In the Sepik region of New Guinea, leaves of *C. thalictroides* are used for personal adornment (Joshi et al., 2019).

Despite the global distribution of *C. thalictroides*, no significant traditional use has been reported among indigenous or local communities in the Americas.

Scientific perspective: Scientific research has confirmed that *C. thalictroides* is a rich source of iron and folic acid. These two micronutrients are essential for haematopoiesis and cellular development. Given these nutrients, the species can be included in the diet to help prevent anaemia (Chotimah et al., 2013). In addition, the species contains carbohydrates—starch and sucrose—as well as lipids, which support its dietary use. Furthermore, the species has a secondary metabolite profile, which includes tannins, saponins, flavonoids, phenolic compounds, reducing sugars, and steroids (Behera et al., 2022).

An in-depth phytochemical analysis revealed the presence of several amino acids and their derivatives, such as L-arginine monohydrochloride, L-hydroxyproline, L-valine, L-tyrosine, and L-glutamic acid (Mandal and Mondal, 2012). Four protein-degrading enzymes were identified in the species: pepsin A, pronase, trypsin, and a cysteine protease (Li, 2006). The proteolytic activity of these enzymes may underlie reported effects in humans, such as facilitating protein digestion, alleviating inflammation and swelling, and accelerating tissue repair. The species' unique structural elements, such as callose and lipid matrices, have also been linked to its medicinal properties (Arulappan et al., 2015).

From a medical perspective, the species has scientifically documented haemostatic properties that justify its traditional use (Singh, 1999). Moreover, antibacterial tests using methanol and water extracts have shown significant inhibition of the growth of *Streptococcus mutans*, implicated in dental disease, and *Shigella flexneri*, which

contributes to dysentery (Behera et al., 2022).

Despite its nutritional and pharmacological properties, scientists point to the potential toxicity of the species, suggesting that further toxicological studies are needed before it can be used more widely as a dietary component (Joshi et al., 2019).

Chloris gayana Kunth

Family:
Poaceae Barnhart

Synonyms:
Eustachys gayana (Kunth) Mundy, *Chloris abyssinica* Hochst. ex A.Rich., *Chloris glabrata* Andersson, *Chloris repens* Hochst.

Vernacular names:
Argentina (Spanish): callide, cosia, grama rhodes, hierba rhodes, pasto italiano, pasto de rodas, pasto rhodes, rhodes grass; **Bolivia** (Spanish): pasto rhodes; **Brazil** (Portuguese): capim-de-Rhodes; **Costa Rica** (Spanish): zacate gordura; **Democratic Republic of Congo** (Lega): bibangu, ibangu, kibangu; **Dominican Republic** (Spanish): yerba rhodes; **Finland** (Finnish): laidunviuhkaheinä; **Greece** (Greek): χλωρίς (chloris); **India** (English): giant rhodes, rhodes grass; **India** (Kannada): rhoolsoohullu; **International** (Arabic): نومسرب (berr-ess-ssmūn/brssmūn); **International** (Chinese): 蓋氏虎尾草 (Gài shì hǔ wěi cǎo), 非洲虎尾草 (Fēi Zhōu Hǔ Wěi Cǎo); **International** (English): abyssinian grass, hunyani grass, rhodes grass, rhodesian blue grass; **International** (French): chloris, herbe de Rhodes; **International** (German): Rhodesgras; **International** (Italian): Erba di Rhodes; **International** (Portuguese): capim-de-Rhodes; **International** (Russian): хлорис гайянская (Khloris Gayyanskaya); **International** (Spanish): grama de rodas, grama rhodes, pasto de rodas, zacate gordura; **Israel** (Hebrew): סודור בשע (esev Rhodes), isbat hammir'eh, ינאיוג סירולכ (Kloris Goyani), הָעַרְמַה תַבְשַע (Esbat ha-Mir'eh); **Japan** (Japanese): アフリカヒゲシバ (Afurikahigeshiba), ローズグラス (Rōzugurasu); **Kenya** (Pokot): kutongoi; **Kenya** (unclassified): longomwagandi; **Mexico** (Spanish): pasto de rodas, pasto rhodes, pasto rhodex, rhodes, zacate, zacate conejo, zacate de rodas, zacate rhodes, zacate rodhex; **Nigeria** (Fula-Fulfulde): pagamri; **Nigeria** (Hausa): garaaji, kanarin dookii; **Philippines** (Filipino): banuko, koro-korosan; **Poland** (Polish): chlorynka; **South Africa** (Afrikaans): bruinvingergras, Rhodes chloris, Rhodesgras, rooiklossiesgras; **South Africa** (English): Hunyani grass, Rhodes chloris, Rhodes grass, Rhodesian blue grass; **South Africa** (Zulu): inyankomo; **Spain** (Catalan): cloris; **Taiwan** (Chinese - Traditional): 蓋氏虎尾草 (Gài shì hǔ wěi cǎo); **Thailand** (Thai): ya-rot; **Turkey** (Turkish): Rodos otu; **Vietnam** (Vietnamese): coả rhodes, tucgiéâ.

Conservation value: -

Distribution:
The native range of *Chloris gayana* is Macaronesia, tropical and southern Africa, and parts of the Arabian Peninsula. It has been widely introduced across tropical and subtropical regions worldwide, including the Americas, northern Africa, parts of southern Europe, Asia, the Pacific Islands, and parts of the United States and Australia (POWO, 2025).

Habitat:
Chloris gayana thrives in a wide range of open habitats, including grasslands, savannas, riverine woodland, degraded woodland, roadsides, floodplains, and disturbed or cultivated sites. It is highly adaptable and occurs from sea level up to approximately 2,000 m in elevation. The species performs well in subtropical and tropical climates, with optimal growth in areas receiving 600–750 mm of annual rainfall, though it can persist in regions with as little as 300 mm or as much as 4,000 mm per year (Cook et al., 2005). It tolerates a variety of soil types, including sandy, loamy, and moderately clay-rich soils, and prefers pH ranges from 5.5 to 7.5. *C. gayana* is moderately tolerant of salinity and temporary waterlogging, although it is sensitive to prolonged flooding and acidic or aluminium-rich substrates (Fish et al., 2019).

Invasiveness:-

It is regarded as an invasive in Australia, Spain, Argentina, Paraguay, Mexico, Costa Rica, Cuba, Anguilla, New Caledonia, New Zealand and Hawaii (Rojas-Sandoval, 2022).

Ethnobotany:

Cultural and traditional uses: *Chloris gayana* plays a key role in traditional subsistence farming throughout its range. In Africa, its native range, this grass is deeply rooted in both agricultural and pastoral practices, and in cultural knowledge about land management and animal husbandry. Kenyan smallholder farmers living in the less fertile highlands of the country incorporate *C. gayana* into their cut-and-carry animal feeding systems. It is traditionally recognised as a reliable forage species by the Pokot and Turkana pastoralist communities (Timberlake, 1994). This grass is mainly harvested during the rainy season. During the dry season, it is used as a nutritious supplement to low-quality roughage such as maize and groundnut stalks. In addition, it is often combined with *Pennisetum purpureum*. This feed mixture significantly increases daily weight gain in cattle (Andrews et al., 2004). In Uganda, it is a particularly valued species as fodder in regions such as the Mukono District. There, it is used both for grazing and for cutting to feed later in barns (Hamill et al., 2003). The situation is similar in Ethiopia. According to studies conducted among the local Ethiopian population, *C. gayana* ranks third among the most commonly cultivated fodder crops (Duncan et al., 2020). Nigerian Fulani cattle herders value *C. gayana* not only as a source of feed, but also as an ecological indicator. Due to its presence on sandy and nutrient-poor soils, these herders use it to assess land productivity (Burkill, 1985). In countries such as Sudan and South Sudan, *Chloris gayana* is also cultivated as an important species for livestock feed. The important role of this grass in traditional grazing systems on the Saiq Plateau in

the Jebel Akhdar Mountains of Oman is evidenced by its frequent presence in the faeces of goats, sheep, and donkeys. This indicates that free-ranging animals naturally include it in their diet (Al Harthi et al., 2008). In Morocco, where the species was introduced, *C. gayana* has been included in mixed feed systems together with species such as *Dactylis glomerata*, *Setaria nigrirostris*, *Panicum muticum*, *Trifolium pratense*, and *Medicago sativa*. These nutritious mixtures have proved particularly effective for grazing animals in semi-arid areas (Maroc. Ministère de l'agriculture, 1933).

The intercontinental expansion of this species into global pastoral systems began with the introduction of *C. gayana* to Australia in 1902–1905. By 1909, it had been introduced to the United States, where it gained particular recognition as a forage plant in Florida and Texas. Later, it reached South America, arriving in Brazil in 1910. At the beginning of the 20th century, it could even be found in pastoral systems in island regions such as Montserrat and Puerto Rico (Royal Botanic Gardens, 1919; Sotomayor-Ríos and Pitman, 2001). The internationally known name of the grass, 'Capim de Rhodes', commemorates the person mainly responsible for its spread — Cecil Rhodes, a British imperialist and businessman who initially promoted its cultivation in South Africa.

After its introduction outside Africa, *Chloris gayana* has integrated into local agro-pastoral systems. In Colombia, the plant is often cultivated in hot lowland regions, where it also frequently naturalises. Its cultivation is driven by local farmers' appreciation of its frost resistance and strong root system. Furthermore, its use extends beyond fodder and includes practical applications such as stabilising coastal dunes (Perez-Arbelaez, 2022). Also in Brazil, *C. gayana* has become an important forage grass. According to local accounts dating back to its introduction into the region's agricultural systems, it was valued primarily for its palatability to cattle, whether fed fresh or dried. In addition, Brazilian farmers valued its hay, which is aromatic, has a long shelf life, and is resistant to frost, retaining its green leaves during cold seasons (Corrêa, 1926a). *C. gayana* has also found similar uses in Argentina (Cantero et al., 2019) and Mexico (Blanckaert et al., 2007). Local communities living in the Tehuacán-Cuicatlán Biosphere Reserve graze livestock on fallow fields after harvest, and also cut this grass to feed animals in home gardens (Blanckaert et al., 2007).

Beyond its primary role as livestock fodder, this species is used in various local cultures. For example, in Kenya, the longer stems of *Chloris gayana* are used in rural households for traditional roofing (Burkill, 1985). This grass is also used for soil stabilisation, particularly in sandy and coastal areas, especially in Colombia and Brazil (Corrêa, 1926a; Pérez-Arbeláez, 2022).

Beyond its material significance, *C. gayana* has also been incorporated into some local beliefs.

Among the Baganda people of Uganda, this plant is traditionally associated with fertility and protection against miscarriage. In one practice documented in the Mukono District, the entire plant is buried under the house of a woman who wishes to become pregnant. This is believed to aid conception (Hamill et al., 2003).

Scientific perspective: *C. gayana* is one of the most productive tropical grasses, yielding 10–25 t DM ha^{-1} yr^{-1} under suitable conditions (Cook et al., 2005; Feedipedia, 2013). The crude protein content ranges from 3% to 17%, influenced by environmental conditions and the grass's phenological stage (Cook et al., 2005). Studies classify this species as feed of medium energy value, suitable as a supplement to balanced ruminant diets (Feedipedia, 2013). Notably, its performance in saline areas is a key advantage. Under salt stress, animals fed hay from *C. gayana* utilised fodder more efficiently and gained more weight than those fed salt-tolerant sorghum (Attia-Ismail, 2015). Its proven tolerance to salinity increases the species' value for reclamation efforts. It is often cultivated on degraded soils where other forage species cannot survive (Burkill, 1985; Attia-Ismail, 2015; Hasanuzzaman et al., 2019).

Additionally, the plant's spreading habit, combined with abundant nodal rooting, allows it to act effectively as a soil binder and cover crop, confirming its use in soil stabilisation (Burkill, 1985; Wells et al., 1986; Hasanuzzaman et al., 2019).

Despite its agronomic value, *C. gayana* exhibits some undesirable qualities. Its aggressive growth and spread have led to its classification as a problematic weed in some parts of Latin America and Asia, negatively affecting traditional agricultural practices (Blanckaert et al., 2007).

Cleome gynandra L.

Family:
Cleomaceae Airy Shaw

Synonyms:
Gynandropsis gynandra (L.) Briq., *Pedicellaria gynandra* (L.) Chiov., *Gynandropsis pentaphylla* (L.) DC., *Cleome pentaphylla* L.

Vernacular names:
Angola (Kimbundu/Kikongo/Ovimbundu): Kasangu, Mozambe, Mozembue, Musambe, Muzambue, Ompungu; **Australia** (English): African spider flower, Wild spider flower; **Barbados** (diasporic/Creole): Massambee, Mozambe, Sambo; **Benin** (Adja): sabo; **Benin** (Bariba): garcia; **Benin** (Cotafon, Fon, Mahi, Péda, Saxwè): akaya, kaya; **Benin** (Dendi): foubey; **Benin** (Ditamari): titchéfowounti; **Benin** (Fè): akaya, èfun; **Benin** (Fon and Mahi): akaya; **Benin** (Gourmantché): agariyaana; **Benin** (Holly): djén'djé, efè oko; **Benin** (Idasha): efo; **Benin** (Kotokoli): sowounboyi; **Benin** (Natimba): kiyépiéti; **Benin** (Watchi): axwouéssamboé; **Benin** (Wama): kaassia; **Botswana** (Gumare, Setswana): Leketa, Rothwe; **Botswana** (Kalanga): Nyevi, Nyovi; **Botswana** (Nambya): ishwungwa; **Botswana** (Setswana): rothwe; **Botswana** (Setswana, Shorobe region): Leketla, Rothwe; **Botswana** (Tswana/Kalanga/Herero): akeyo, akio, alot-dek, amazonde, bangara, bekeila-ki-dakhan, borothwe, chiisaka, chinsaga, deg-akeyo, dek, ecadoi, echaboi, ekurukaze, esaka, gasiyaabu, goma/horob,

gomabeb, isagek, isakiat, isakyat, ithea-utuku, jibiri, jirri, kinaski muskuari, kisakiat, kpawum, lasaitet, lemba-e-nabo, lerotho, lerotu, lisaka, lude, luni, mgagani, muanga, mukakai, munyugunyugu, murudi, murutivi, mutete, mwaanzo, mwangani, mwianzo, naibor-lukunya, nasege, nyeve, oljani-lo-ol-tatwa, olmuateni, ombidi, omboga, ombowa, ombowa yozongombe, ombowayozondu, omdidi, omutete, rothwe, runhi, runi, sabai, sachan, saka, sake, sakiantet, suriya, suriyo, suroyo, thageti, thagiti, thikwirimurimbo; **Burkina Faso** (Moré): Kelebdo; **Burkina Faso** (Shien): nianié; **Burkina Faso** (unspecified region): Caya blanc; **Burundi** (Kirundi): isogi; **Cambodia** (Khmer): ប័ន្សុស (Makhnrouh); **Cameroon** (Doondo): loukaya-louakoutou; **Cameroon** (Fulfulde): Kinaski, Worba; **Central African Republic** (Banda): Va; **Central African Republic** (Gbanu): Banga-uzele; **Central African Republic** (Goula): Ndomba; **Central African Republic** (Mandja): Wabandari; **Central African Republic** (Sara): Wa; **China** (Chinese [simplified]): 羊角菜 (yángjiǎo cài); **China** (Henan): 白花菜 (báihuācài), 羊角菜 (yángjiǎocài); **China** (Wú): bai hua cai; **China** (Yunnan/Shandong): 白花菜 (báihuācài), 羊角菜 (yángjiǎocài), 白花草 (báihuācǎo); **Côte d'Ivoire** (Agni): ouataï; **Côte d'Ivoire** (Baoulé): wè tè; **Côte d'Ivoire** (Gouro): sango; **Côte d'Ivoire** (Shien): niamé; **Cuba** (Spanish): hierba del cuche, volantin; **Democratic Republic of the Congo** (Bembe): Mshesala; **Democratic Republic of the Congo** (Kongo C Province): mumpala; **Democratic Republic of the Congo** (Koongo): mvoua-vouagna; **Democratic Republic of the Congo** (Lingala/Kikongo): chishugwa, lubanga, lyuniyi, shungwa, sishungwa, Suntha; **Democratic Republic of the Congo** (Mashi): Muhole; **Dominican Republic** (Spanish): Masambey; **Egypt** (Arabic): abu quarn, arareeg, tamaleekah; **Ethiopia** (Amharic/Oromo): boekbeha, gargama; **Ethiopia** (Tigrinya): boekbeha, bokhbeha, gargama; **Finland** (Finnish): vihanneslukkikukka; **French Guiana** (diasporic/Creole): Akaja, Akaïa, Caïa; **Ghana** (Akan): tɛtɛ; **Ghana** (Ga-Dangme): kɛtɛ, tɛtɛ; **Ghana** (Gbe): afumoe, amãgã, awumɛ, sɔbui, sɔgbee, solui, sɔlwi; **Ghana** (Hausa): garsar; **Ghana** (Kusal): kaa; **Ghana** (Moore): tiɛlɛbdo; **Ghana** (Nankanni): nanjinda; **Guadeloupe** (diasporic/Creole): Massambee, Mozambe; **Guinea** (Maninka – Waslunka): passo-ni-kuna; **Guinea** (Maninka): oassi-ni-kuna; **Guinea** (Manding-Maninka): nonselé; **Hong Kong** (Chinese [traditional]): 白花菜

(báihuācài); **India** (Assorted regional languages): acakanta, acakantacceti, acakantam, acakantar, acakanti, acanrika, acaya, ajagandha, anasorisa, apiramimuli, arkahuli, arkapushpi, arkapushpika, arkkaputpikam, arttacantirakam, atunari vela, avigandha, ayirapatam, barbaragandha, barbaraka, bastagandha, bhatvan, bhutmulla, bodhayika, brahmi, bramhagrabha, bugra, camukavalai, camukavalaicceti, camulavam, camuppavam, cara-veela, caravella, caruvalai, caruvelai, caruvelaicceti, carvalai, carvella, cattai, cattiravacceti, cattiravan, choraka, churota, cippatimuli, cippativelacicceti, curacapirutam, curacu, curucavarttam, dhavi-tiloni, dhelitalavan, dog mustard, gandi buti, hurhur, jakhiya, kabari, kadugu, kalvana, kananvelai, kanavelai, kanavelaicceti, kanphodi, kara-vela, karaila, karalia, karavela, karnasphota, karnaspota, karvela, kattu kadugu, katuvu, kavalaicceti, kavalia, kavelai, kavilaicceti, kavilay, kaykantitam, kayvelai, kayvelaicceti, kharapushpa, kiloni, kirikaala, kotimatalatti, lalhulhul, maamballi

gida, mabli, mankali, mantu, mhoti tilavana, motithiavan, motitilavan, naarumbele, nai-velai, naivela, naivelai, nal valai, nal velai, nallavelai, nalvelai, naram bele soppu, nayeet-ulasi, nayvelai, palaiyamvivitam, pandari-tilvan, pandhari-tilwan, pandharithilavan, pandharitilavan, pandhri-tilvan, pantumai, parhar, parpari, parpericceti, pashugandhaa, pasugandha, paśugandhā, piranalvelai, porra-maram, puncari, puncaricceti, putigandha, putimayurika, puutigandhaa, pyasya, ridhi, safed hulhul, seta kanta arak, seta kata arak, shirikaala, shreekala, shrikala, shulte, sirikala gida, sooryaavartha, sooryavarta, sugandhika, surjavarta, svetahulahula, tai-vela, taivela, taivelai, taivlai, taiy, talvani, tamanorupani, taruvali, tayirvelai, thaivaalai, thaivelai, thella vamita, thilani, thilavana, thiloni gida, thivezhai, tilani, tilapanni, tilapannicceti, tilaparni, tilavana, tilparni, tilvan, tilvant, tungi, ugragandha, uluvacakenti, uluvacakenticceti, vaaminta, vacukantikkay, vaivinta, vaminta, varvar, vayinta, vaylee, vela, velai, velakura, yetakoora; **India** (Hindi): hulhul, karaila, kurkur; **India** (Hindi/Bengali): karaila, kurkur, sada-hurhuria; **India** (Marathi): पांढरी तळिवण (Pāṇḍharī tiḷvaṇ); **Indonesia** (Bahasa Indonesia/Javanese): babowan, boboon, enceng-enceng, ent jengent, langsana, leug-lengan, mamang, merah; **Indonesia** (Indonesian): Mamam, langsana merah, mamang; **International** (Chinese): pe hua tsai; **International** (Dutch): Afrikaanse spinbloem, kattesnor; **International** (English): African cabbage, African herbage, African spider flower, bastard mustard, cat's whiskers, small spider flower, spider flower, spider plant, spider wisp, suryavarta, white massombee; **International** (French): cleome, feuilles caya, gynandro, Mozambe, mouzambe à fleurs blanches; **International** (German): Benzoïnbaun, Fieberstrauch, Senfkapper, bienenblume, fingerkraut, fingerspinat; **International** (Mandarin): 白花菜 (bái huā cài), 白花菜子 (bái huā cài zǐ), 羊角菜 (yáng jiǎo cài); **International** (Russian): Клеоме тычинко-пестичная (Kleome týchinko-pestíchnaya); **International** (Spanish): caya, volatín, volantincillo; **Israel** (Hebrew): שמוחם ושאב (Bashan mechumash), baashan; **Japan** (Itawit): davuravu; **Japan** (Japanese): フウチョウソウ (Fūchōsō); **Kenya** (Bunyala): lisaka; **Kenya** (Gikuyu): thageti, thagiti; **Kenya** (Kamba): saget; **Kenya** (Kikuyu): keyo, mkabili; **Kenya** (Kikuyu/Luo/Kamba/Swahili): akio, akeyo, alot-dek, bakeriya-dahan, chosoka, chinsaga, dek, deg-akeyo, echaboi, esaka, isakiat, isakayt, isoget, karelmet, keyo, kisat, kisiat, lemba-e-nabo, lisaka, luni, mbwili, mkabili, mwanzo, munyugunyungu, mutaka, mwangani, nsila, oluatení, oljani-lool-tatwa, sabai, sake, saget, saki, saka, sakiantet, suriyo, suriya, tagiti, thagiti, tisaka, uy-gurreh; **Kenya** (Luo): akeyo, chinsaga; **Kenya** (Luyia): esaka, lisaka, tsisaka; **Kenya** (unspecified): goma/horob, hurhuria, isagek, isakiat, isakyat, ithea-utuku, kinaski muskuari, kisakiat, kpawum, lasaitet, lemba-e-nabo, lerotho, lerotu, lude, mwianzo, naibor-lukunya, nasege, olmuateni, ombowayozondu, uatai, ulube, ulude, umuzimu, umzonde; **Lao PDR** (Lao): sièn; **Macau** (Chinese [traditional]): 白花菜 (báihuācài); **Madagascar** (Malagasy): manam, mamang; **Malawi** (Chichewa/French): Brede caya, pissat des chiens; **Malawi** (Chichewa/Yao/Tumbuka): luni, mutaka, nsila; **Malaysia** (Malay): bastard mustard, kachang bulu rimau, langsana merah, mah-mah, maman, maman hantu, maman puteh, maman putih, mamang, mamen hantu; **Malaysia** (Malay, Besut): maman, maman pasir; **Mali** (Bamanankan): naségé; **Mali** (Fulfulde): gasiyaahu, kinaski, worba; **Martinique** (French): Acaya blanc, mouzambe à fleurs blanches; **Martinique** (French Creole): acaya blanc; **Martinique** (diasporic/Creole): Akaja, Akaïa, Caïa; **Mauritius** (Creole): bastard mustard, Brede caya, erotho, Lerotu, Mozambe, spider flower, spider wisp; **Mongolia** (Mongolian): jalguun tsetseg; **Morocco** (Arabic): kaul; **Myanmar** (Khmer, Central): momiënh; **Myanmar** (Burmese): caravalla, gangala, hingala, taw-hingala; **Namibia** (Kwanyama/Ovambo): ombidi, omdidi; **Namibia** (Oshikwanyama): ombidi; **Namibia** (Oshindonga): omboga; **Namibia** (Ovambo/Herero/Tswana/Kalanga): akeyo, akio, alot-dek, amazonde, bangara, bekeila-ki-dakhan, borothwe, chiisaka, chinsaga, deg-akeyo, dek, ecadoi, echaboi, ekuru-kaze, esaka, gasiyaabu, goma/horob, gomabeb, isagek, isakiat, isakyat, ithea-utuku, jibiri, jirri, kinaski muskuari, kisakiat, kpawum, lasaitet, lemba-e-nabo, lerotho, lerotu, lisaka, lude, luni, mgagani, muanga, mukakai, munyugun-yugu, murudi, murutivi, mutete, mwaanzo, mwangani, mwianzo, naibor-lukunya, nasege, nyeve, oljani-lool-tatwa, olmuateni, ombidi, omboga, ombowa, ombowa yozongombe, ombowayozondu, omdidi, omutete, rothwe, runhi, runi, sabai, sachan, saka, sake, sakiantet, suriya, suriyo, suroyo, thageti, thagiti, thikwirimurimbo; **Nepal** (Nepali): hur hure, junge phul, seta kanta arak, seta kata arak, tori jhar; **Nigeria**

(Chamba): tee-bu(-noh); **Nigeria** (Fula-Fulfulde): gasiyaahu, kinaski; **Nigeria** (Gwari): amaddo; **Nigeria** (Hausa): diyar ungwa, garsar, gaasayaa, tabadai, tabadamashe, tabaday; **Nigeria** (Nupe): lanti bókùn; **Nigeria** (Tiv): gashia; **Nigeria** (Yoruba): ekesi-masun, èkùyá, èkùyáko, èkùyalé; **Pakistan** (Saraiki, Taunsa Sharif): hurhur; **Pakistan** (Urdu): hurhur; **Philippines** (Aklanon): haIaya, huIaya; **Philippines** (Cebuano): balaya; **Philippines** (Filipino): apoiapoian, cinco-cinco, silisihan; **Philippines** (Ilocano): manabo, tantandok, tantandok-a-dadakel; **Philippines** (Tagalog): apoyapoyan, apoy-apoyan, bala-balanoyan, cinco-cinco, silisihan, tantandok; **Philippines** (Tagalog/Visayan): apoipoian, balabalansyan, cinco-cinco, hulaya, silisihan, tantandok; **Puerto Rico** (Spanish): jasmin del rio, small spider flower, volantes de cinco hojas, white massombee; **Réunion** (French/Creole): Aija; **Rwanda** (Kinyarwanda): Isogi; **Senegal** (Manding-Bambara): naségé; **Senegal** (Serer): korgona, safoybidum; **Senegal** (Serer-Non / Nyominka): nakayorel; **Senegal** (Serer-Sine): korgona, safoybidum; **Senegal** (Wolof): gor bu di daw, nakayorel, n-gor si bidaw; **Singapore** (Malay): manam, mamang; **Somalia** (Somali): aija; **South Africa** (Afrikaans): african spider flower, bastard mustard, bienenblume, inheemse kool, oorpeultjie, oorpynpeultjie, palmbossie, rusperbossie, snotterbelletjie, vinger-blaarte, vingerblaarspinasie, vingerblaartee, wilde kool; **South Africa** (English): african cabbage, african herbage, bastard mustard, kaffir cabbage, spider flower, spiderwisp, spiderwisp spindlepod; **South Africa** (Ndebele): ulude, lude, ulede; **South Africa** (Northern Sotho): lerotho; **South Africa** (Pedi): lerotho, morogo wa lerotho; **South Africa** (Sepedi): leroto; **South Africa** (Sotho): Lirudu; **South Africa** (Sotho [Northern]): lerotho; **South Africa** (Tsonga): bangala; **South Africa** (Tswana): rothwe; **South Africa** (Venda): murudi, muruvidi, munimvi, nimvi; **South Africa** (Xhosa/Zulu/Afrikaans): agyiri, akaki, tamaleika, ziri; **Sri Lanka** (Sinhala): වේලා (vēlā), wela; **Sudan** (Arabic): mgagani, mwage-nazi, tamaleekah; **Sudan** (Arabic – Algoz, South Kordofan): tamalaika; **Sudan** (Arabic/Dinka): tamaleika, akaki; **Sudan** (Mòoré): kelebdo, tiɛlɛbdo; **Suriname** (diasporic/Creole): Akaja, Akaïa, Caïa; **Suriname** (historic/African-Surinamese): atita; **Suriname** (Vlaams): kattesnorharve; **Taiwan** (Chinese [traditional]): 白花菜 (báihuācài); **Tajikistan** (Tajiki): kaul; **Tanzania** (Bondei): mbwesi za mwitinyi; **Tanzania** (Kinyarwanda): Isogi; **Tanzania** (Swahili): akeyo, ejjobobyo, eshogi, isaga; **Tanzania** (Swahili/Posta area market): mgagani; **Tanzania** (Swahili/Sukuma): akeyo, ecaboi, ekabo, ekiau, ekeyo, ejjoboyo, eshogi, eshoje, eyobyo, isaga, jirri, tegeri; **Tanzania** (Yao): mbweso za mwitinji; **Tanzania** (unspecified): magani, mgagani, mwage-nazi, mwanga, mwitu shemsi; **Thailand** (Isaan Laos, Kalasin): phak sian; **Thailand** (Thai): ผักเสี้ยน (Phak Sian), phak sian, phak sian khaao, phak sian khao, phak som sian, phak som stan; **Togo** (Éwé): agmãgã, awumɛ, soboe, solui, sɔbui, sɔgbee, sɔlwi; **Turkey** (Turkish): örümcek bitkisi, örümcek çiçeği, kleam; **Uganda** (Acholi): akeyo, kinaski, nasege; **Uganda** (Alur): akeyo; **Uganda** (Karamoja): akau; **Uganda** (Lugbara/Gis/Bar/Madi/Kig/Tr): asaaka, ejjoboyo, eshoje, eshogi, isaga, jiribi, jirri, tegiri; **Uganda** (Luganda): gasaya; **Uganda** (Ngakarimojong): akeo; **Uganda** (Runyankole): mutete; **Uganda** (Runyoro): eyboyo; **Vietnam** (Vietnamese): màn màn, màn màn hoa trắng, man ma tia, màn ri trắng, m[af]n m[af]n tr[aws]ng; **Yemen** (Arabic – southern governorates): Raab; **Zambia** (Bemba): mgagani; **Zambia** (Bemba/Nyanja): bangara, elude, gangara, nyehve, nyevhe, rumi, tsinga, ulude, ulede; **Zambia** (To/Bemba/Lamba/Nyanja): chishungwa, lubanga, lyuni, msunta, namanga, nagaholo, sishungwa, siungwa, lutembwe; **Zimbabwe** (Shona): foubey, nyovhi, nyevhe, nyeve, rudhe, rune, sunha, tsuna; **Zimbabwe** (Shona/Ndebele): elude, nyeuhe.

Conservation value: -

Distribution:

Cleome gynandra is native to tropical and subtropical regions of the Old World. Its natural distribution spans much of sub-Saharan Africa, including West, East, and Southern Africa, the Arabian Peninsula, the Indian subcontinent, South-east Asia, northern Australia, and numerous islands in the Indian Ocean and the western Pacific. It has been extensively introduced throughout the tropical and subtropical New World, and is now naturalised in parts of the south-eastern United States, Central America, the Caribbean, northern South America, and several island systems across the Pacific and Atlantic Oceans (POWO, 2025).

Habitat:

Cleome gynandra typically occurs in disturbed habitats, such as roadsides, fallow fields, cultivated land, field margins, and forest edges. It is commonly found in ruderal and secondary vegetation, particularly in full sun and on well-drained soils. The species is ecologically versatile, occurring in both dry and moist lowland tropical environments. It thrives in open habitats and is frequently associated with agricultural systems and seasonally wet areas. Its altitudinal range extends from sea level up to 2,400 m in East Africa and parts of Asia (Beentje, 2000; Rao and Kumar, 2024).

Invasiveness:

Cleome gynandra is considered invasive in several regions outside its native range, especially in tropical and subtropical areas of the Americas and Pacific Islands. Although it is not currently listed in the Global Invasive Species Database (GISD, 2025), it has been recognised as an invasive weed in regional assessments. In the United States, the species is spreading in the south-eastern states, including Florida, Georgia, and Texas, where it has recently been reported as a new agricultural weed (DiTomaso, 2024). It is also considered invasive or naturalised in Hawaii, Fiji, and other Pacific Islands, where it establishes quickly in disturbed habitats and agricultural fields (Plant Pono, 2025).

Ethnobotany:

Cultural and traditional uses: *Cleome gynandra* is considered an important leafy vegetable used in the culinary cultures of tropical and subtropical regions of Africa and Asia. All above-ground parts of the plant are used for food. The young shoots and leaves are usually eaten after boiling or stewing, which helps to remove excessive bitterness.

According to ethnobotanical reports, this species is consumed across Africa, including Togo (Sogbohossou et al., 2018), Benin (Dansi et al., 2009), Angola (Urso et al., 2016), the Central African Republic (Vergiat, 1969), South Africa (Arnold et al., 1985), Mauritius (Suroowan et al., 2019), and Ethiopia, where it is considered a famine food

(Alemu et al., 2024). The importance of this plant in the famine diet of local peoples is further evidenced by reports from Ngara District, Tanzania, where it was among the key food sources in camps set up in 1994–1995. These camps sheltered civilians fleeing the genocide in Rwanda and the civil war in Burundi during the Great Lakes refugee crisis (Ramathal and Ngassapa, 2001).

Nevertheless, in some countries, the plant has become an important ingredient in everyday dishes. In the South African district of Vhembe, its leaves are cooked with tomatoes and served with porridge (Constant and Tshisikhawe, 2018). In Burkina Faso, in a few villages, this plant is added to vegetable sauces poured over *tô*, a staple food, a thick, doughy porridge usually made from cereals such as millet, sorghum, or maize flour (Guissou et al., 2015; Kiebre et al., 2015). This species is also used in traditional dishes in Ghana, the Democratic Republic of the Congo, Kenya, Malawi, Zambia, Uganda, Zimbabwe, Namibia, Laos, Gabon, Nigeria, Senegal, Cameroon, Sudan, and Tanganyika (in present-day Tanzania), where the slightly spicy and sour taste of *Cleome gynandra* has gained appreciation among local people. In these countries, the leaves of the plant are generally added to stews, often with milk or peanut paste, as in the case of the Cameroonian sauce *haako hilɓo*. They are also often combined with cowpea (*Vigna unguiculata*) or amaranth (*Amaranthus* spp.) (Burkill, 1985; Chweya and Mnzava, 1997; Chifundera, 2001; Tourneux, 2005; Glew et al., 2009; Anywar et al., 2014; Konda Ku Mbuta et al., 2015). It is also served with fish and onions in dishes such as *nsanye* or *njangsa* sauce, in which the base is a paste made from *Ricinodendron heudelotii* seeds (FAO, 1988; Ezekwe, 2014). Dishes made from *C. gynandra* are of particular importance in Kenya. Reports from Kenya indicate that dishes prepared from this plant are served to guests of honour, pregnant women, nursing mothers, and convalescents. This emphasises the cultural, nutritional, and medicinal importance of the plant (Chweya and Mnzava, 1997).

The situation is similar in Asia, where the plant is consumed both as an ingredient in dishes and as a condiment for sauces (Chweya and Mnzava, 1997). In India, China, Indonesia, Laos, Taiwan, Cambodia, and the Philippines, it is cooked or marinated and added to dishes. In southern Yemen, the leaves of this species are often cooked together with *Cissus rotundifolia* to enhance the flavour of the dish (Al-Fatimi, 2021). As in South Africa, in Vietnam *C. gynandra* leaves are traditionally served with tomatoes and porridge (Võ Văn Chi, 1991). In Thailand, a notable food product made from *C. gynandra* is pak-siandong, a fermented leaf condiment. This consists of fermented leaves with added salt and sugar, served as a popular side dish (Facciola, 1990). Fermentation and pickling are also practised in India, Malaysia, and Cambodia (Chweya and Mnzava, 1997; Wiart, 2006). Another popular form of plant preservation, used in both Asia and Africa, is drying.

For this purpose, in countries such as Vietnam, Namibia, South Africa, and Botswana, the leaves are dried in the sun (Rodin, 1985; Võ Văn Chi, 1991; Neudeck et al., 2012; Constant and Tshisikhawe, 2018). In Namibia, *C. gynandra* is traditionally dried in the form of cakes called omavanda, sun-dried leaf cakes (Rodin, 1985). To prepare them, the fresh leaves are first washed and boiled with a pinch of salt, sometimes onion, oil, or tomatoes, then kneaded by hand into flat cakes or fist-sized balls while still hot (Malan and Owen-Smith, 1974; Chataika et al., 2020). These cakes are then dried until crisp. The resulting omavanda can be stored for several months, after which it is eaten once soaked and slow-cooked with sorghum, millet, or maize porridge (Mnzava and Chigumira Ngwerume, 2004; Chataika et al., 2020). The practice of drying the leaves and storing them as dried cakes or balls is also common in other parts of Africa, and in this form it is sold at local markets (Grubben and Denton, 2004).

Apart from the stems and leaves of *C. gynandra*, the plant's pungent seeds are also used as a spice in local cuisines. In both Africa and Asia, the seeds are traditionally crushed and used as a substitute

for mustard (Kunming Institute of Botany, 1979; Burkill, 1985; Facciola, 1990). Oil is also extracted from the seeds of this species. It is used, for example, in the traditional cuisine of Henan Province (Henan Economic Botany Records, 1963). In various tropical regions, all above-ground parts of this species are eaten, including the flowers, which often add both flavour and aesthetic value to local dishes (Facciola, 1990).

The medicinal versatility of this species is also well known throughout its range. According to available reports from Benin and Togo, *C. gynandra* is used to treat 42 different conditions, including malaria, headache, earache, anaemia, and malnutrition (Sogbohossou et al., 2018). In Mauritius, the entire plant is recognised as an effective diaphoretic, anthelmintic, carminative, and antispasmodic agent (Suroowan et al., 2019). In India, this species is known as a remedy for scorpion stings (Jain and DeFilipps, 1991, cited in DeFilipps and Krupnick, 2018). In Henan Province, China, it is used for skin swelling, wounds, eczema, and malaria (Henan Economic Botany Records, 1963). Cultures in Asia and Africa also agree on the use of seeds in folk medicine. Throughout its native range, decoctions are taken to combat intestinal parasites (Kunming Institute of Botany, 1979).

It is worth focusing on a few main conditions for which this plant is used. The use of this plant in the treatment of respiratory tract disorders has been recorded in both Africa and Asia. Traditional healers in the aforementioned Ngara refugee camps in Tanzania prepared decoctions from this species for people suffering from lung infections (Ramathal and Ngassapa, 2001). Infusions of *C. gynandra* have been used for bronchitis in the Bushi region in the Democratic Republic of the Congo (Chifundera, 2001). In Uganda, this plant is known as a remedy for chest pain and discomfort (Chweya and Mnzava, 1997). In Vietnam, both the leaves and roots of this plant are traditionally used to treat coughs and asthma (Võ Văn Chi, 1991).

Traditional medicine from various cultures recognises the use of *C. gynandra* as a remedy for fever, especially fever associated with malaria. Its use in reducing fever has been reported in South Kordofan in Sudan, Angola, and South Africa, where decoctions of the plant were used for this purpose (Wiart, 2006; Urso et al., 2016; Issa et al., 2018). In India, a decoction of the seeds (half a cup twice a day) is taken for fever. In Malaysia, a decoction of 30 g of seeds is administered for malaria (Wiart, 2006). In Henan, China, the crushed plant, mixed with wine, was used to treat the disease (Henan Agricultural College, 1959).

Crushed leaves of *Cleome gynandra* are also commonly applied in treating dermatological conditions. Burkill (1985) noted the use of this species for such purposes in Gabon and Côte d'Ivoire, where, in addition to treating boils, leaf poultices are applied for neuralgia. In the Bukavu region of the Democratic Republic of the Congo (DRC), crushed leaves are applied to finger abscesses (Konda Ku Mbuta et al., 2015). Similarly, in Vietnam, crushed leaves mixed with salt are applied for various skin diseases, including boils (Võ Văn Chi, 1991). Additionally, similar uses of the plant have been reported in Nepal (Dani and Tiwari, 2013), Malaysia (Awang et al., 2020), India (Jain and DeFilipps, 1991), Pakistan (Mustafa et al., 2023), and the Chinese province of Henan (Henan Economic Botany Records, 1963).

Gastrointestinal disorders are another widely reported indication for this species in folk medicine. For example, *Cleome gynandra* is a popular remedy for stomach pain and food poisoning in Uganda (Anywar et al., 2014). In Ghana, it has reportedly been administered for constipation (Glew et al., 2009). Meanwhile, in China and Indonesia, it is used to relieve flatulence (Wiart, 2006), and in Pakistan, the leaves are taken for diarrhoea (Mustafa et al., 2023). Other noted uses of the plant include the treatment of abdominal pain in India, constipation in Burkina Faso, and detoxification in Vietnam and Cambodia (Burkill, 1985; Chweya and Mnzava, 1997; Wiart, 2006). Furthermore, this plant is known as an antiparasitic agent in the DRC (Burkill,

1985; Chifundera, 2001).

Cleome gynandra also plays an important role in traditional medicine in treating headaches, ear and eye inflammation, and related sensory disorders. In Mauritius, crushed leaves are placed in the ears to relieve headaches (Suroowan et al., 2019). Similarly, infusions of the plant are used in Uganda, where they are sometimes applied as eye and ear drops to prevent infections (Anywar et al., 2014). The leaf juice is also applied as ear drops, as observed in traditional medicine in Ghana, India, and Pakistan (Burkill, 1985; Mustafa et al., 2023). Moreover, leaf juice is administered to relieve headaches in Cameroon, South Africa, and Benin; in these cases, it is rubbed into the palms and then inhaled (Burkill, 1985). Among the Dan people of Côte d'Ivoire, ash from the plant is mixed with oil and rubbed into the temples (Vergiat, 1969). The use of *Cleome gynandra* for ear inflammation has also been reported in the DRC and Ethiopia. Eye applications have likewise been reported in Tanganyika (modern-day Tanzania) and Nigeria (Burkill, 1985; Chifundera, 2001; Alemu et al., 2024). Similar uses have also been reported in some Asian countries. In Vietnam, the plant is also used externally for headaches (Võ Văn Chi, 1991), and in Nepal, it is used to relieve both ear and head pain (Dani and Tiwari, 2013).

Cleome gynandra is also important in ethnomedicine related to maternal care. For example, in Tanzanian refugee camps, the plant was believed to have oxytocic properties and was therefore given to mothers to facilitate childbirth (Ramathal and Ngassapa, 2001). In many African countries, it is also given to women both during pregnancy and after childbirth to strengthen their bodies (Chweya and Mnzava, 1997; Grubben and Denton, 2004). Interestingly, as with postpartum women, the plant was also given to warriors after battles in which they had suffered significant blood loss to speed up their recovery (Grubben and Denton, 2004).

As for the seeds, in traditional medicine they are mainly employed for musculoskeletal disorders, such as arthritis and rheumatism. They are often used in combination with leaf poultices. The treatment of joint pain and inflammation using this plant has been documented, among others, in Sudan, Nigeria, Mauritius, Côte d'Ivoire, India, Pakistan, Malaysia, and Vietnam (Burkill, 1985; Võ Văn Chi, 1991; Wiart, 2006; Issa et al., 2018; Suroowan et al., 2019; Mustafa et al., 2023).

In addition to the main types of conditions treated with *Cleome gynandra* mentioned above, numerous publications list a broader range of conditions treated with it across regions where it grows. In Kenya, leaves boiled in sour milk are traditionally considered a remedy to improve eyesight and boost energy, and are therefore administered to treat marasmus in children (Chweya and Mnzava, 1997). In the Democratic Republic of the Congo, infusions of the plant are known as an effective remedy for lymphadenitis and mumps (Chifundera, 2001). In Vietnam, it is traditionally used for detoxification and blood purification (Võ Văn Chi, 1991), while in Malaysia it is used to treat hepatitis, hypertension, and diabetes (Wiart, 2006; Awang et al., 2020). Similarly, in Saudi Arabia, infusions of *C. gynandra* are used to treat diabetes and muscle weakness, and as an adjuvant in cancer therapy (Azab, 2025). In India, the leaves have been used to treat neuralgia (Jain and DeFilipps, 1991), and a decoction of the seeds has been used to treat convulsions (Wiart, 2006).

C. gynandra also plays an important role in ethnoveterinary practices in Africa and parts of Asia. This species is often used for its anthelmintic properties. In many countries in Africa and Asia, decoctions prepared from the seeds are given to livestock to eliminate internal parasites (Kunming Institute of Botany, 1979). In India, these decoctions are used not only to treat parasites, but also to treat colic in horses (FAO, 1988). In addition to the seeds, the roots of the plant are used to control parasites. The use of infusions from the underground parts of the plant for this purpose has been reported among the farming populations of Burkina Faso and Kenya (Chweya and Mnzava, 1997). Seed oil is valuable for

controlling external parasites. On both continents, this oil is used to kill lice and their larvae in domestic animals and humans (Võ Văn Chi, 1991; Chweya and Mnzava, 1997; Wiart, 2006).

The plant's pungent smell helps to combat parasites and pests. This property is exploited in Henan Province, China, where the plant is used as a repellent. In addition to repelling insects, farmers also use it to deter snakes and rats, which is particularly appreciated in poultry farming (Henan Economic Botany Records, 1963).

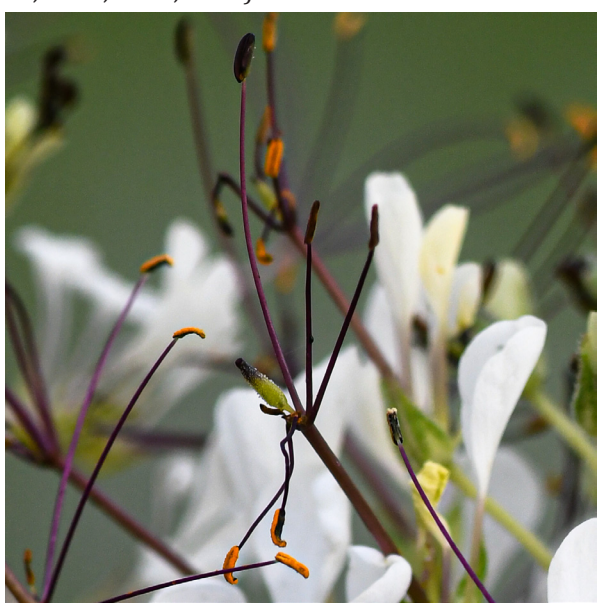
Additionally, there are reports that the seeds of *C. gynandra* have traditionally been used as *piscicide*. In several African regions, fish are obtained by throwing the seeds into water bodies; compounds in the seeds cause the fish to float to the surface, making them easy to collect (Chweya and Mnzava, 1997; Grubben and Denton, 2004).

Due to the multitude of uses of *C. gynandra*, this species has also gained economic importance in some areas. It has been shown to contribute to seasonal income, especially among rural women in Namibia, Kenya, and South Africa (Achigan-Dako et al., 2021). In Benin, the Ewe people cultivate this plant on a commercial scale. At local markets, the leaves are sold for US$0.25–1.10 per kg, while the seeds are sold for US$5.00–16.70 per kg (Sogbohossou et al., 2018).

C. gynandra has had a significant impact on local communities and has contributed to the development of local cultural and ritual traditions. In the Habru district of Ethiopia, dried leaves are burned and inhaled during rituals to drive away evil spirits (Alemu et al., 2024). Similar uses have been reported in Benin and Togo among ethnic groups such as the Adja, Zerma, and Fon (Sogbohossou et al., 2018). In the Oubangui region (now the Central African Republic), *C. gynandra* is associated with the magical realm. According to folk tales, it is usually cultivated by sorcerers who use it to make poisons. The recipe for one such poison is to pound the leaves and seeds of the plant together with putrid toad skin into a paste. This paste is then dried and used as a poison that causes abdominal swelling. The remedy for this is a decoction of *Pycnocoma minor*, *Berlinia grandiflora*, and other local species (Vergiat, 1969).

Numerous practices and beliefs associated with the use of this plant have influenced the methods of harvesting it. For example, in the village of Gumare, Botswana, there is a taboo against harvesting this plant with fingernails. This prohibition is linked to the belief that leaves damaged during harvesting become excessively bitter (Tselaesele et al., 2023).

Evidence suggests that the use of *C. gynandra* in ritual ceremonies in Africa dates back to ancient times. Recent research on a vase from the Faiyum Oasis, from the Ptolemaic period, found that residues in the vessel contained a mixture of *Cleome gynandra*, *Peganum harmala*, *Nymphaea nouchali*, and fermented fruit. This mixture was probably used to induce visionary states during an incubation ritual, i.e., entering a sleep state intended to be a channel of communication with a deity (Tanasi et al., 2024; Azab, 2025).



Scientific perspective: The wide use of *Cleome gynandra* in traditional cuisine is directly related to its nutrient content and bioactive compounds that support its health-promoting properties. Although like many leafy vegetables it provides

relatively little energy (approximately 142 kJ, or 34 kcal, per 100 g fresh weight), it has a high protein content (about 4.8 g/100 g fresh weight) (BFN, 2018; Mashamaite et al., 2022). The plant is notable for its rich micronutrient content. In fresh plant material, vitamin A (β-carotene) content ranges from 2.6–18.9 mg/100 g (fresh weight), and vitamin C from 13–484 mg/100 g (fresh weight). These variations depend on both the plant's provenance and preparation methods. Cooking can reduce vitamin C content by up to 81%, and drying by up to 95% (Chweya and Mnzava, 1997). Fertile soils generally increase protein concentration, but may reduce β-carotene, vitamin C, and iron (Grubben and Denton, 2004; Mashamaite et al., 2022). *Cleome gynandra* also exhibits high levels of minerals. In dry matter, iron is about 47 mg/100 g, and calcium ranges from 126–288 mg/100 g. The plant has high concentrations of magnesium, zinc, and phosphorus (Grubben and Denton, 2004; Glew et al., 2009). The plant's oleaginous seeds further enhance its nutritional value. The oil is rich in polyunsaturated fatty acids, especially α-linolenic acid (omega-3, accounting for 58.2% of the oil), and oleic acid (omega-9). In addition, it has a very favourable omega-6 to omega-3 ratio (~0.1), which is rare in plant products (Glew et al., 2009; Omondi et al., 2017). This oil may therefore have beneficial effects on cardiovascular health and metabolism.

This nutritional profile helps explain its traditional use in postpartum and convalescent diets, and as an aid in recovery from anaemia or other conditions resulting from nutrient deficiencies. Nutritional studies in rodents have shown improved haematological parameters when diets were supplemented with this plant, which may be attributed to its high iron, folic acid, and protein content (Uusiku et al., 2010). Compared with other leafy vegetables, including cabbage and Swiss chard, *C. gynandra* has a nutritional advantage in terms of its micronutrient and omega-3 content, as well as its antioxidant potential (Mashamaite et al., 2022).

The rich phytochemical profile of *Cleome gynandra* also underpins its many uses in traditional medicine. Some of the best-studied components are glucosinolates, including cleomin and glucocapparin. These compounds are hydrolysed by the enzyme myrosinase to form isothiocyanates, which are known for their antibacterial, rubefacient, and blistering properties (Grubben and Denton, 2004; Wiart, 2006). The plant also contains large amounts of flavonoids, such as quercetin and kaempferol. These compounds contribute primarily to the plant's anti-inflammatory, antioxidant, and antidiabetic effects (Narendhirakannan et al., 2005; Sudan and Karthikeyan, 2022). In addition, the antibacterial and astringent effects are influenced by polyphenols, iridoids, tannins, and alkaloids contained in the plant (Achigan-Dako et al., 2021). The essential oils present in both the seeds and leaves are rich in carvacrol and senevol, which are responsible for the plant's pungent smell and bitter taste. Carvacrol also has strong antibacterial and acaricidal properties (Burkill, 1985).

Laboratory studies have confirmed that ethanol extracts from the leaves inhibit fungal pathogens such as *Trichophyton rubrum* and *T. mentagrophytes*, which are responsible for fungal infections in humans. In addition, antibacterial tests of the extracts showed significant inhibition zones (20 mm) against *Enterococcus faecalis*, which is responsible for numerous infectious diseases (Imanirampa and Alele, 2016; Abhilasha et al., 2021). The antibacterial and anti-fungal activity is generally attributed to the action of the aforementioned carvacrol, isothiocyanates and flavonoids (Omondi et al., 2017). Laboratory studies have also confirmed that *Cleome gynandra* exhibits anti-malarial and antipyretic activity. In one study, a combination of methanol extract and ethyl acetate at a dose of 50 mg/kg eliminated 73% of *Plasmodium berghei* in infected mice. This result is comparable to the standard anti-malarial drug halofantrine at a dose of 25 mg/kg (Igoli et al., 2016). This confirms the validity of the traditional use of this plant in Vietnam and other regions as an antipyretic and

detoxifying agent (Võ Văn Chi, 1991). In the context of the plant's use as a metabolic health and antidiabetic agent, ethanol extracts from shoots (500 mg/kg) have been shown to lower fasting blood glucose levels and normalise metabolic parametres within four weeks (Sudan and Karthikeyan, 2022).

Laboratory studies have confirmed that ethanolic leaf extracts inhibit fungal pathogens such as *Trichophyton rubrum* and *T. mentagrophytes*, which are responsible for fungal infections in humans. Moreover, antibacterial tests of the extracts showed significant 20-mm inhibition zones against *Enterococcus faecalis*, which is responsible for numerous infectious diseases (Imanirampa and Alele, 2016; Abhilasha et al., 2021). These antibacterial and antifungal activities are generally attributed to carvacrol, isothiocyanates, and flavonoids (Omondi et al., 2017). Laboratory studies have also demonstrated that *Cleome gynandra* exhibits antimalarial and antipyretic activity. In one study, a combination of methanolic extract and an ethyl acetate fraction at a dose of 50 mg/kg eliminated 73% of *Plasmodium berghei* in infected mice. This result is comparable to the standard antimalarial drug, halofantrine, at a dose of 25 mg/kg (Igoli et al., 2016). This confirms the validity of the traditional use of this plant in Vietnam and other regions as an antipyretic and detoxifying agent (Võ Văn Chi, 1991). In the context of the plant's use as a metabolic health and antidiabetic agent, ethanolic extracts from shoots (500 mg/kg) have been shown to lower fasting blood glucose levels and normalise metabolic parameters within four weeks (Sudan and Karthikeyan, 2022).

The traditional use of the plant for dermatological problems, including anti-inflammatory compresses and the treatment of rheumatic pain, is attributed mainly to the properties of isothiocyanates derived from glucosinolates. These compounds act as both warming and antibacterial agents (Wiart, 2006).

Furthermore, studies have reported the acaricidal properties of the plant. In field-cage experiments, fresh leaves of this plant killed or repelled 100% of ticks of the species *Rhipicephalus appendiculatus* and *Amblyomma variegatum* (Malonza et al., 1992). Moreover, larvicidal activity of preparations from *C. gynandra* against *Culex quinquefasciatus* mosquitoes has been demonstrated (Grubben and Denton, 2004).

Despite the numerous useful properties of the plant, caution should be exercised when using it. Glucosinolates found in *Cleome gynandra*, such as progoitrin, are known to inhibit iodine absorption, which poses a risk of thyroid dysfunction if the plant is consumed in large quantities. Nevertheless, traditional preparation methods, such as cooking and fermentation, significantly reduce the levels of these substances in the plant (Wiart, 2006; Uusiku et al., 2010).

Cleome rutidosperma DC.

Family:

Cleomaceae Airy Shaw

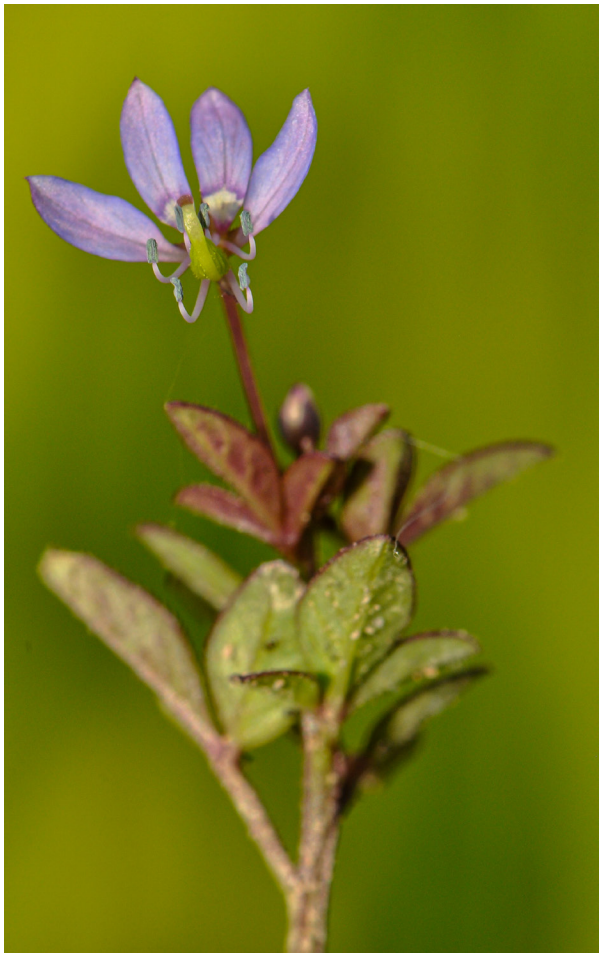
Synonyms:

Sieruela rutidosperma (DC.) Roalson and J.C.Hall

Vernacular names:

Australia (English): fringed spider flower, spiderplant; **Bangladesh** (Bengali): Beguni Hurhure, Nil Hurhure; **Benin** (Adja): Bomasabo, Gbessabo; **Benin** (Cotafon): Gbétokaya; **Benin** (Fon): Akayá; **Benin** (Gourmantché): Agariyana; **Benin** (Holly): Etayi, Eyitayi; **Benin** (Mahi): Aiya; **Benin** (Otammari): Ticefunti; **Benin** (Waama): Tèwon; **Benin** (Watchi): Assonboué; **Brazil** (Portuguese): musambe, mussambé; **Cameroon** (Bafut): Amborrenja; **Cameroon** (Bassa): Macomagniaga; **Cameroon** (Bouda): Mephomonze; **Cameroon** (Bulu): Abongo; **Cameroon** (Douala): Mbango; **Cameroon** (Ewondo): Elog nsom; **Cameroon** (Kpe): Lovanga; **Central African Republic** (Monzombo/Aka): inzi; **Democratic Republic of the Congo** (Kikongo): benshami, ietete, mgagani, munsemfi; **Democratic Republic of the**

Congo (Kirega): musaka; **Democratic Republic of the Congo** (Kirega/Kikongo): munsemfi; **Democratic Republic of the Congo** (Lingala): batina-ba-baku, bokoka, bokuma, bonsambili, bosambi, intenga, kapalapala, lilila, lisalankanga, mabumbu, matundo, montende-minu, musaka, sofi-n'seke, yonde-ya-okombo; **Democratic Republic of the Congo** (Nyindu): mushaka kanamafuji; **Democratic Republic of the Congo** (Songola): mualá; **Democratic Republic of the Congo** (Swahili): mgagani; **Democratic Republic of the Congo** (Wagenia): kalábó, tolábó; **Gabon** (Fang): dougo dougo; **Ghana** (Akan): tete; **Ghana** (Akan-Akyem): tete; **Ghana** (Asante): tete; **Ghana** (English): spiderplant, fringed spider flower; **Ghana** (Nankanni): nanjinda; **Guangdong** (Chinese/Mandarin): 皱子白花菜 (zhòu zi bái huā cài); **Hong Kong** (Chinese/Mandarin): 皱子白花菜 (zhòu zi bái huā cài); **India** (Dimasa/Assam): Phuliar lada; **India** (Odisha): Anasorisha; **India** (Tamil/Vallavilai): Neelavela; **India** (West Bengal): Torel; **Indonesia** (Indonesian): Maman Ungu; **Indonesia** (Madurese): Bhubuan; **Indonesia** (West Timor/Tetun): Lakaur; **International** (Mandarin): 敏子白花菜 (mǐn zǐ bái huā cài); **International** (French): mouzambe rampant; **International** (German): Runzelsamige Kleome; **International** (Russian): Клеоме морщинистосемянная (kleome morshchinistosemyannaya); **Japan** (Japanese): アフリカフウチョウソウ (afurika fūchōsō); **Lesser Antilles** (English): consumption weed; **Lesser Antilles** (French Creole): mouzambe rampant, petit acaya blanc; **Macau** (Mandarin): 皱子白花菜 (zhòu zi bái huā cài); **Malaysia** (Malay): maman, maman pasir, seru walai; **Malaysia** (Tamil): Sēru walai; **Mayotte** (Shimaoré): M'kazi, Sari m'ramli; **Mexico** (Spanish): jazmín de río; **Myanmar** (Karen—Wah-Theinkha village): Taw Hin, Galar; **Nigeria** (English): fringed spider flower; **Nigeria** (Ethiope East, Delta State): Ekuya; **Nigeria** (Fula-Fulfulde): kinaski ciile; **Nigeria** (Hausa): garseya; **Nigeria** (Igbo): àkidìmmọ́ó; **Nigeria** (Igbo - Owerri): àkidìmmọ́ó; **Nigeria** (Ijo-Izon - Kolokuma): àgbàlálà; **Nigeria** (Izon): àgbàlálà; **Nigeria** (Izon - Oporoma): àgbàlálà, kàlá àwọ̀ù èg̈ïnà; **Nigeria** (Nupe): èyà kapangi, fángi'tí bǒkǔ; **Nigeria** (Yoruba): Àràkáníkáde, Èkùyá Àjà, Èkùyá Òrìṣà, Eriwo, Erú Èbùré, Etaré; **Philippines** (English): spindletop; **Portugal** (Portuguese): musambe; **Republic of the Congo** (Laadi): lukaya lwa makutu; **Republic of the Congo** (Téké): munseke nseke, kibali; **Taiwan** (Chinese - Traditional): 平伏莖白花菜 (píng fú jīng bái huā cài), 成功白花菜 (chéng gōng bái huā cài); **Thailand** (Thai): **ผักเสียนขน** (phak sian khon); **Yoruba-speaking regions** (Yoruba): Àràkáníkáde, Èkùyá Àjà, Èkùyá Òrìṣà, Eriwo, Erú Èbùré, Etaré.



Conservation value: -

Distribution:

Cleome rutidosperma is native to tropical Africa, with its natural range extending from Cape Verde across tropical Africa, through the Indian subcontinent, to Myanmar. It has been introduced to numerous regions worldwide, including parts of Asia (e.g., Andaman Islands, Bangladesh, south-central and south-eastern China, and Nepal), the Americas (e.g., Florida, northern Brazil), and various islands across the Pacific and Indian Oceans (e.g., Comoros, Hawaii, Taiwan, and the Windward Islands) (POWO, 2025).

Habitat:

Cleome rutidosperma grows primarily at low altitudes in ruderal, humid, and hot conditions. It is typically found up to 400 m elevation in regions with annual rainfall ranging from 1,700 to 3,000 mm. Occasionally, it is recorded as a weed at elevations up to 1,200 m. The species occupies a wide range of habitats, including water margins, swamps, coastal sands, coastal forests, cultivated fields, gardens, fallow land, roadsides, and other disturbed or waste areas (CABI, 2025). In China, it is found among paddy fields, along stream sides, and in wetlands. The species can also grow as an epiphyte on rock faces and trees (Wu et al., 2008). This taxon is pantropical. In tropical Africa, it is most frequent in coastal regions. Occasionally, it has been recorded as a weed in East Africa (Uganda, Tanzania). In Nigeria, it occurs as a weed in rice fields (Grubben and Denton, 2004).

Invasiveness:

Outside its native range, *Cleome rutidosperma* is widely considered an invasive or naturalised weed, particularly in South and South-East Asia, the Pacific Islands, and parts of the Neotropics. It spreads rapidly in disturbed urban and agricultural areas due to its short life cycle, fast growth, and abundant seed production. Its sticky seeds aid dispersal via animals, machinery, footwear, and water, enhancing its colonisation ability. Although this species is not listed in the Global Invasive Species Database (GISD, 2025), it is recognised regionally as a problematic, noxious, or invasive weed throughout most lowland wet tropical areas of Asia and Australia (Grubben and Denton, 2004). It is also invasive on Niue, and its presence in central Australia has caused concern (Popay et al., 2003, and Wu et al., 2008).

Ethnobotany:

Cultural and traditional uses: *Cleome rutidosperma*, like *Cleome gynandra*, is used as a leafy vegetable by people living in Africa and Asia. For example, it is widely recognised as a food source by the Nyindu people living in the Democratic Republic of the Congo (DRC) (Yamada, 1999). In the Equateur Province of the DRC, the young leaves are used as a spice due to their pungent, peppery taste, and are sometimes sold in local markets (Latham and Konda ku Mbuta, 2017). In the regions of Bas-Congo, Equateur, Bandundu, and the historic region of Orientale, the plant is consumed as part of the daily diet. The young shoots are coarsely chopped, then cooked with oil and water (Konda ku Mbuta et al., 1992). In Uganda, the leaves are cooked as a vegetable or added to soups, often served with clarified butter to help temper their bitter, spicy taste (Grubben and Denton, 2004). In southern Benin, the Adja people, in addition to harvesting the leaves of *C. rutidosperma*, cultivate it sporadically for domestic use. Its leaves are added to sauces with corn or yam paste. The plant's importance as a food source is bolstered by its tolerance of the dry season (Dansi et al., 2008b). Communities living in southern Benin, such as the Watchi, Adja, Holi, Cotafon, and Mahi, also consume the leaves of this species, preparing them in the same way as spinach (Dansi et al., 2008b). The consumption of the leaves of this plant as a vegetable has also been documented among the populations of Ghana and Gabon (Grubben and Denton, 2004).

Outside Africa, *C. rutidosperma* is eaten in India, where the Dimasa tribe of Assam adds its leaves to traditional vegetable dishes (Nath et al., 2016). It is likewise eaten by the Madurese people of eastern Java and the Tetum ethnic group living in West Timor (Taek et al., 2018; Al Yamini et al., 2023).

The use of *Cleome rutidosperma* in local medical traditions encompasses the treatment of a wide range of ailments, from dermatological problems to neurological and mental disorders. In Africa, the juice from the leaves of this plant is commonly used to treat ear ailments. Among both the Wagenia and Kiregia peoples of the Democratic Republic of the Congo, fresh leaf juice is instilled directly into the ear to treat inflammation (Bokdam and Droogers, 1975; Konda ku Mbuta et al., 2012). The Laadi and Téké peoples of Congo use a concentrated decoction of the plant for this purpose (Bouquet, 1969). The plant is also used as a remedy for earache in other regions

of the country (Konda ku Mbuta et al., 1992; Latham and Konda ku Mbuta, 2017). Similar practices take place in Ghana, Gabon, and Nigeria, and among the Gourmantché community living in the western Sudan region and Benin (Grubben and Denton, 2004; Idu et al., 2007; Achigan-Dako et al., 2010). In Cameroon, juice from the aerial parts of the plant is used as eye drops to treat eye infections (Abondo et al., 1991). Similar uses of this plant have been reported in the Niramkaitha Kotta Hills in Kerala and Tamil Nadu in India. According to reports, it is used there to treat earache, inflammation, and deafness (Kumar et al., 2019; Sukhadev et al., 2022).

Cleome rutidosperma is also used to treat gastrointestinal disorders. For this purpose, the Ewondo people of the Mbalmayo region of Cameroon add the leaves of this species to their meals to help combat intestinal worms (Noumi and Yomi, 2001). In addition, traditional use of this plant for the treatment of colic has been reported in the Democratic Republic of Congo (Konda ku Mbuta et al., 1992). As for the Asian continent, the Karen ethnic group living in Myanmar uses the whole plant as a remedy for constipation and diarrhoea (Zarli et al., 2021).

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Furthermore, the anti-inflammatory properties of *Cleome rutidosperma* are used to treat malaria and fever. For example, a decoction of the plant is used to combat malaria in Benin (Achigan-Dako et al., 2010). A similar use is reported in the Indian state of Tamil Nadu (Kumar et al., 2019), and in West Timor, Indonesia, where the Tetun people use a decoction of the plant externally in baths to treat fever. This is related to the local classification of the plant as 'cold', a humoral classification indicating, among other effects, fever-reducing properties (Taek et al., 2018).

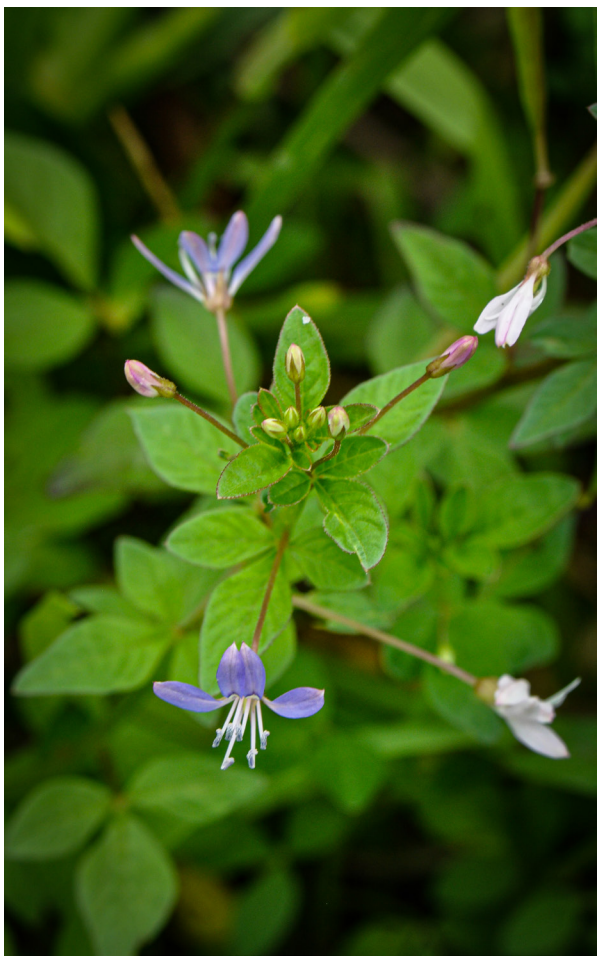
Cleome rutidosperma is an important component of local medicine for reproductive health. This is the case in the southern forest zone of Cameroon, where the entire plant is used to treat female infertility. A decoction of the leaf stalks helps regulate menstrual cycles (Jiofack et al., 2010a). Similarly, in the Democratic Republic of the Congo, the plant is used to support the treatment of infertility (Konda ku Mbuta et al., 1992). This property is noted on the island of Mayotte, off mainland Africa, where local residents use the roots of this plant to treat impotence (Tam-Hui et al., 2025). In addition, the plant's use in obstetric medicine is reported in Cameroon. Communities such as Bafut, Bassa, Bouda, and Douala use the entire plant to treat inflammation of the foetal membranes (Njamen et al., 2013).

In the context of dermatological health, *Cleome rutidosperma* has been used to treat skin conditions and wounds throughout its native range. In the Republic of the Congo, the Laadi and Téké communities use the juice of the plant to treat cuts (Bouquet, 1969). Similarly, in Ghana, an extract from the leaves is used as a remedy for skin irritation (Grubben and Denton, 2004). Wound-healing properties are reported on the island of Mayotte (Huat et al., 2021). Among the populations of eastern Ethiopia and Nigeria, the juice of the plant is used to clean wounds and ulcers infected with larvae (Idu et al., 2007). A similar use of this plant is reported in the state of Odisha in India, where root juice is used to treat parasitic skin infections (Marndi et al., 2020).

With regard to its importance in traditions related to neurological and mental health, the plant is used to treat convulsions in Nigeria (Grubben and Denton, 2004; Idu et al., 2007). The use of the plant for the treatment of mental disorders is documented primarily in the Democratic Republic of the Congo. An example is the practice of the Kirega people in Mbandaka, who use water extracts from the leaves

as eye and nasal drops to treat mental disorders (Konda ku Mbuta et al., 1992; Konda Ku Mbuta et al., 2012; Latham and Konda Ku Mbuta, 2017).

Other uses of *Cleome rutidosperma* in traditional medicine include using a decoction of the plant as a mouthwash to combat tooth decay among the Kirega people in the Democratic Republic of the Congo (Konda Ku Mbuta et al., 2012). In Cameroon, the plant is used to treat heart pain and repel lice among the population (Abondo et al., 1991; Jiofack et al., 2010a).



Scientific perspective : Research on the nutritional value of *Cleome rutidosperma* has shown that 100 g of fresh leaves contain 5.5 g of protein, 10.1 g of carbohydrates, 0.9 g of fat, 1.7 g of fibre, and provide 239 kJ (57 kcal) of energy. This species has a high mineral content: calcium (454 mg), magnesium (38 mg), phosphorus (59 mg), and iron (27 mg), which may significantly enhance its importance in local diets (Grubben and Denton, 2004).

Phytochemical studies have identified at least 74 bioactive compounds in methanol extracts. These include phenolic compounds, such as quercitrin; alkaloids, like indoline and indole-3-acrylic acid; amino acids and amines, such as hercynine and phytosphingosine; and terpenes, including trichothecene (Motmainna et al., 2024). Characteristic components of the roots include terpenoids, saponins, and phenols (Marndi et al., 2020).

Extracts from *Cleome rutidosperma* have been extensively studied, demonstrating, among other activities, anti-inflammatory, antipyretic, analgesic, antibacterial, and antioxidant properties (Williams, 2013). Nevertheless, the use of this species in the treatment of sickle-cell anaemia has not been confirmed (Amujoyegbe et al., 2016). By contrast, the antimalarial activity of *Cleome rutidosperma* has been reported: ethanolic extracts showed moderate inhibitory activity against *Plasmodium falciparum* (IC_{50} = 34.4 µg mL^{-1}), whereas aqueous extracts showed no significant activity (IC_{50} > 100 µg mL^{-1}) (Taek et al., 2018).

Studies on rats have also shown that methanol and aqueous extracts from the roots significantly accelerate wound healing and epithelialisation. In addition, histological analyses showed improved collagen alignment and reduced inflammatory cell infiltration, supporting the beneficial effect of the plant on the treatment of difficult-to-heal wounds (Mondal and Suresh, 2012).

In the context of digestive health, the plant's anthelmintic efficacy has been evaluated. Ethanolic extracts from the leaves paralysed and killed *Fasciola* spp. flukes in a dose-dependent manner. Moreover, at the highest concentration, the efficacy exceeded that of albendazole, a popular antiparasitic drug (Luis et al., 2021).

Finally, studies indicate that an ethanolic extract from the whole plant (administered at a dose of

200–400 mg kg^{-1}) exhibits a clear anticonvulsant effect against pentylenetetrazole-induced petit mal seizures in mouse models. These extracts also exhibit moderate anxiolytic activity (Bose et al., 2012). Overall, these findings largely support the traditional uses of this plant.

Cleome viscosa L.

Family:
Cleomaceae Airy Shaw

Synonyms:
Arivela viscosa (L.) Raf., *Corynandra viscosa* (L.) Cochrane and Iltis, *Polanisia viscosa* (L.) DC., *Sinapistrum viscosum* (L.) Moench

Vernacular names:
Andaman and Nicobar Islands (Nicobarese): Kulching; **Australia** (English): Asian spiderflower, mustard bush, spider flower, tickweed, wild caia, wild mustard, yellow cleome; **Australia** (Walmajarri): Jirlpirringarni; **Bangladesh** (Bengali): হলদে হুড়হুড়ে (Haldey Hurhurey), হলুদ মাকড় ফুল (Holud Makar Phul), Hurhur, Hurhuria; **Benin** (Fon): Agbodokaya, Wawa, Itè, Feromoni; **Borneo** (Malay): Ketupeng, Mamang utan; **Cambodia** (Khmer): ម៉ាញ្ចុះម៉ាច (môhêanh khmôch), Momienh khma'ch, Momienh; **Cape Verde** (Portuguese Creole): Musambe; **China** (Hainan): 臭矢菜 (chòu shǐ cài); **Côte d'Ivoire** (French): Acaya jaune, Brède caya, Cléome visqueuse, Cléome gluante, Collant, Mouzambe jaune; **Cuba** (Spanish): Uña de gato, Volantín, Quita ruina; **Dominican Republic** (Spanish): Frijol cimarrón, Jitomate, Tabaquillo; **East Himalaya** (Nepali): Ban tori, Hurhure; **Egypt** (Arabic): ظفرة لزجة (Dhafra lazga); **Ethiopia** (Tigrinja): behbehá; **Ghana** (Dagomba): Bùdùnì; **Guam** (Chamorro): monggos-paluma, monggos-paloma; **India** (Assamese): Atharua, Hurhuria; **India** (Bengali): Hurhuria; **India** (Garhwal Himalaya): Jakhiya; **India** (Gujarati): Kan Phuti, Pilitalvani, Pili Talavani, Talavani; **India** (Hindi): Ban Sirsu, Dog mustard, Hurhur, Hurhur or Bagra, Hulahula, हुलहुल (Hulhul), Jangli hurhr, Jakhiya, Junglee Hur-Hur, Jurutia, Bagra, बगरो (Bagro),

जख्या (Jakhya), Pili hurhur; **India** (Kannada): Antu saasive gida, Gandunaa balli, Haladi gida, Haladimaamballi, Kaadu saasive, Naayi sasive, Nayibela, Nayi sasive; **India** (Khonds tribe, Paderu, Andhra Pradesh): Vamita; **India** (Konkani): Tiḷoṇī kāṇphuṭī; **India** (Malayalam): Aadunarivela, Ariyavela, Karimkadugu, Kattukadugu, Manjavela, Naikkadugu, Naivela, Pattikaduku, Vaikadugu, Vela, Atunari vela; **India** (Marathi): Bhatvan, Mabli, पविला तळिवण (Pivala tilavan), Pivala tilvan, Tilavan, Tilvant; **India** (Oria): Anasorisa, Anasorisia, Anasorisho, Banosorisho, Hulhulia; **India** (Punjabi): Bugra; **India** (Sanskrit): Adityabhakta, Ajagandha, Arkabhakta, Arkakanta, Arka, Arikahita, Aryaval, Aryavela, Barbara, Bhaskareshta, Brahmakarma, Brahmasuvarchala, Karnasphota, Mandukaparni, Martandavallabha, Pashugandha, Saurii, Shunaca-barbara, Shunakabarbara, Sthala, Suvarchala, Svanabarbara, Svanaburbara, Surasambhava, Suryalata, Suteja, Tilaparni, Varada, Vikranta; **India** (Sikkim): Harhare; **India** (Tamil): Kaattu kadugu, Kattukkadugu, Manja Kadugu, Naai kadugu, Naikkadugu, Naivela, Nayikkadugu,

Pasugandha, Peavali thilvana, Peruvelai, Pili-hulhul, Pivali-tilvan, Piwali-tilwan; **India** (Telugu): Aria-veela, Ariavila, Arikahita, Atunarivela, Bagra, Bagro, Bantakalan, Barbara, Bhaskareshta, Brahmasuvarchala, Gandunaa balli, Harhuria, Harhuriya, Hulahula, Hulhul, Hurhur, Kanfuti, Kookavumitie, Kukkavavulu, Kukka-avalu, Kukka-avulu, Mandukaparni, Manduki, Martandavallabha, Vamita, Varada, Vela, Vinta, Kukkavaminta; **India** (Telugu, Nalgonda District): Vamita; **India** (Urdu): ہلہل (Hulhul); **India** (various languages): Hul-Hul, Pashugandha, Pivala tilvana, Kanphuti, Talwani; **India** (West Himalaya (Garhwali/Kumaoni)): जखया (Jakhya); **Indonesia** (Galela and Tobelo): Mamang utan; **Indonesia** (Indonesian): Ancang ancang, Mamang; **Indonesia** (Javanese): Ancang-ancang; **Indonesia** (Madurese): Bhubhuwan; **Indonesia** (Maluku Malay): Susawi utan; **Indonesia** (Moluccas Malay): Susawi utan; **Indonesia** (Sulawesi): Mamang; **Indonesia** (Sumatra, Malay): Mamang pasir; **International** (Arabic): ذفرة لزجة (Dhafra lazga), Om-Hanif; **International** (Chinese/Mandarin): 白花菜 (bái huā cài), 臭矢菜 (chòu shǐ cài), 羊角草 (yáng jiǎo cǎo), 野油菜 (yě yóu cài), 黄花菜 (huáng huā cài), 黄花草 (huáng huā cǎo), 向天黄 (xiàng tiān huáng); **International** (English): Asian spider flower, caia, cleome, dog mustard, ground dove feed, tickweed, wild mustard, yellow cleome, yellow mesambay; **International** (French): Acaya jaune, Brède caya, Cléome visqueuse, Cléome gluante, Collant, Mouzambe jaune; **International** (German): Klebrige Spinnenpflanze; **International** (Portuguese): Musambe, Bredo-mama, Capim-fedorento, Jasmim-do-rio; **International** (Russian): клеоме клейкая (kleome kleikaya); **International** (Swahili): Mgagani; **Iraq** (Arabic): ذفرة لزجة (Dhafra lazga); **Japan** (Japanese): キパナヒメフウチョウ (kipanahimefûchô), ヒメフウチョウソゥ (hime-futyoso), Himefûchôsô, Kifanahimefûchô; **Laos** (Lao): ຜັກຊອນຕຽນ (phak son tien), Sa phac son tien, Sièn̄z; **Madagascar** (French): Cléome visqueuse; **Madagascar** (Malagasy): Kiafafalahy; **Malaya** (Malay): Ketupeng, Mamang; **Malaysia** (Malay): Ketupeng, Mamang, Mamang kebo, Mamang laki, Mamang utan, Maman pantai, Maman putih, Mahmud pantai; **Maldives** (Dhivehi): Raa-beburi, Raa-beberi; **Mauritius** (French Creole): Brède caya, Pisar lisyen, Pissat de chien, Cléomé visqueuse; **Mayotte** (Shimaore and Kibushi): M'ramli, M'ramli n'dzishe, Ramli, Sary valihandra; **Myanmar (Burma)** (Burmese): Toe-sone, toq; **Nepal** (Nepali): Ban tori, Ban Toree, हुर हुरे (Hur Hure), Hurhure, Methi jhar, Ritori, Sui bhanme, Tori jhar, Toree Jhaar; **Niger** (Béribéri): nome kini; **Niger** (Fulani): lé géléély, lé géllélély; **Niger** (Hausa): gasya mahalba, gashya mahalba, Tafarnuwa kura; **Niger** (Songhai): Ijéerí-lèmtì; **Niger** (Tamacheq): adagall nagasaye, n-aegasay; **Niger** (Zarma): géri lamti, jéri lampti, jéri lanpti; **Nigeria** (Hausa): Namijin yâr unǵuwa, Tafarnuwa kura; **Nigeria** (Nupe): Èyà'zò, timigi, emigi, egiagi, ekpagi; **Nigeria** (Yoruba): Èkúkú igbó, Èkúkú ọ̀dàn, Ekuya; **Pakistan** (Sindhi): Kinni Buti; **Pakistan** (Urdu): ہلہل (Hulhul); **Philippines** (English): wild mustard; **Philippines** (Filipino): Apoy-apoyan, Hulaya, Silisian, Silisilihan; **Philippines** (Ilokano): Tantandok; **Philippines** (Ivatan): Kabau; **Philippines** (Panay Bisaya): Hulaya, Tulayag; **Philippines** (Tagalog): Apoy-apoyan, Balabalanoayan, Balabalanoian, Silisian, Silisilihan; **Philippines** (Tagbanua): Lampotaki; **Saudi Arabia** (Arabic): ام صيف (Um Sayf), ذفرة لزجة (Dhafra lazga); **Senegal** (Pulaar): Niébé lèlli; **Senegal** (Pöl group – Toucouleur): niébé lèlli; **Sudan** (local): Kawal; **Sudan** (South Kordofan local): Koda; **Sudan/South Sudan** (Arabic): ذفرة لزجة (Dhafra lazga); **Taiwan** (Traditional Chinese): 向天黃 (xiàng tiān huáng), 黃花草 (huáng huā cǎo); **Tanzania** (Swahili): Mgagani; **Thailand** (Thai): **ผักเสี้ยนผี** (phak sian phī), phak sian phee, phak som sian phee; **Thailand** (central, peninsular): phak sian phee; **Thailand** (northern): phak som sian phee; **Vietnam** (Vietnamese): Màn màn vàng, Sơn tiên, Sa phac son tien; **Yemen** (Arabic): ذفرة لزجة (Dhafra lazga)

Conservation value: -

Distribution:

Cleome viscosa L. has a native distribution across the tropical and subtropical regions of the Old World. Its natural range includes areas throughout Africa (including North, West, Central, and East Tropical Africa), the Arabian Peninsula, parts of temperate and tropical Asia (e.g., south and south-east China, the Indian subcontinent, Myanmar, Indochina, and New Guinea), as well as parts of Australia (Northern Territory, Queensland, New South Wales, South Australia, and Western Australia). The species has been widely introduced outside its native range

to regions worldwide, including North America (e.g., Florida, New Jersey, and Louisiana), Central and South America (e.g., Colombia, Mexico, and Venezuela), various Caribbean islands, parts of the Pacific (e.g., Fiji, Samoa, and New Caledonia), and Indian Ocean islands (e.g., Comoros, Mauritius, Réunion, and Seychelles) (among others) (POWO, 2025).

Habitat:

Cleome viscosa grows in disturbed, open habitats, including roadsides, field margins, fallow land, cultivated fields, wastelands, and village surroundings. It is common in agricultural systems such as rice and sugarcane fields, where it behaves as a weed (Rojas-Sandoval, 2015c; IDAO CIRAD, 2023). The species prefers well-drained, sandy or calcareous soils and thrives in full sun. It shows considerable ecological adaptability (i.e., capacity to thrive under varying environmental conditions), occurring in both dry and seasonally moist tropical environments, especially in lowland areas from sea level to approximately 1,000 metres in elevation (Lucid Central, 2025).

Invasiveness:

Cleome viscosa is widely considered invasive in tropical and subtropical regions outside its native range, including South and South-East Asia, East Africa, Australia, and many Pacific and Indian Ocean islands. It spreads rapidly in disturbed sites and agricultural systems, particularly in rice and sugarcane fields, due to its short life cycle, prolific seed production, and tolerance of poor or compacted soils (Rojas-Sandoval, 2015c; Lucid Central, 2025). Although the species is not listed in the Global Invasive Species Database (GISD, 2025), it is recognised as a noxious or problematic weed in several regional assessments. Reports from the south-eastern United States (e.g., Florida and Texas) and numerous Pacific islands (e.g., Fiji, Papua New Guinea, and Guam) document its aggressive spread and persistence in open, disturbed habitats (Plantwise, 2025). Its invasiveness is enhanced by sticky seeds dispersed by animals, wind, water, and human activity, enabling rapid colonisation and displacement of native or cultivated plants.

Ethnobotany:

Cultural and traditional uses: In traditional culinary cultures, the leaves, seeds, and young fruits of *Cleome viscosa* are used. The Nupe people of Nigeria commonly refer to this species as 'cowpea's friend', and it is widely known as an 'edible weed' (Blench, 2013). Despite its bitter taste, this plant is consumed in tropical regions of Africa. For example, in Burkina Faso, its leaves are harvested during the rainy season, and are a common addition to sauces (Belem et al., 2014). Fresh, dried, and cooked leaves of the plant are used as an addition to traditional dishes from Cape Verde and Senegal to Egypt, Ethiopia, and Zanzibar. The young fruits are typically marinated with salt and spices, which reduces bitterness and improves the flavour (Burkill, 1985; Grubben and Denton, 2004). On Indian Ocean islands, the plant is consumed in various forms; in Mauritius, it is a typical leafy vegetable (Gurib-Fakim and Brendler, 2004). In Réunion, it is used solely as a raw material for decoctions (Lavergne and Véra, 1989). A comparable diversity of culinary uses is found in Asia. In the Garhwal Himalaya of Uttarakhand, India, the seeds, known as 'jakhiya' (roasted seeds used for tempering and flavouring oil), are an important spice for marinades, sausages, and vegetable dishes. They are also used as a substitute for cumin (*Cuminum cyminum*), valued not only for its flavour, but also for carminative properties that relieve flatulence and digestive complaints (Pardo de Tavera, 1901; Mathur and Joshi, 2013). Due to their importance in local cuisine, the seeds are often traded at traditional markets. According to reports from Uttarakhand, one kilogram of *Cleome viscosa* seeds can be exchanged for seven kilograms of unhusked rice or four kilograms of wheat (Maikhuri et al., 2000). Furthermore, throughout India and South-East Asia, the seeds and pods of the plant are used as a substitute for mustard, and are often added to curries. The leaves and young shoots are often eaten as a separate vegetable side dish, with a slightly pungent, mustard-like flavour

(Pardo de Tavera, 1901; Asolkar et al., 1965–1981; Burkill, 1985; Upadhyay, 2015). In Saudi Arabia, beyond its culinary use, the plant is added to dishes for its appetite-stimulating properties (Al-Shanwani, 1996).

The use of this plant in traditional medicine is deeply rooted in Indian Ayurvedic and Unani traditions. Both ancient texts and modern ethnobotanical studies provide information on its use in the treatment of fever, inflammation, skin diseases, liver diseases, and gastrointestinal disorders. In the Unani system of medicine, the seeds and leaf juice are described as having anthelmintic, antipyretic, and antiseptic properties (Asolkar et al., 1965–1981; Mali, 2010; Chand et al., 2021).

The use of *Cleome viscosa*, hereafter *C. viscosa*, in the treatment of fever is widespread across almost its entire range. In tropical Africa, the leaves and seeds are primarily used to relieve fever (Grubben and Denton, 2004). In the Seychelles and Mauritius, the whole plant is used for this purpose as medicinal decoctions. Additionally, in the Seychelles, crushed seeds mixed with coconut oil are applied topically as a diaphoretic (Gurib-Fakim and Brendler, 2004). In the Philippines, the seeds are recognised as the principal medicinal part used to treat fever (Yeshi et al., 2022). In India, *C. viscosa* is particularly important in the treatment of fever arising from digestive disorders (Asolkar et al., 1965–1981; Mali, 2010; Upadhyay, 2015; Chand et al., 2021). In Saudi Arabia, the plant is recognised for antipyretic properties, including in fevers arising from poisoning (Mossa et al., 1987). Similar use is reported in Nepal, particularly in the Kathmandu Valley (Dani and Tiwari, 2013).

According to local reports, this species has antiseptic properties and is used to treat and prevent a wide range of infections. In tropical African countries, both decoctions of the whole plant and medicinal preparations made from the seeds are used to treat diverse infectious and inflammatory diseases (Grubben and Denton, 2004; Adomou et al., 2012). Traditional Indian medicinal systems recognise the

plant's antiseptic properties in the treatment of skin or ear inflammation (Mali, 2010; Upadhyay, 2015). In the Philippines, the plant is mainly used to wash wounds that have already been infected with larvae (Williams, 2013). The Yaegl Aboriginal community in New South Wales also uses *C. viscosa* to treat skin infections. To prevent wound infections, they apply crushed *C. viscosa* material to the wounds (Packer et al., 2012). Widespread recognition of its antiseptic properties is underlined by concordant uses in Mayotte and Mauritius (Gurib-Fakim and Brendler, 2004; Huat et al., 2021).

The properties of this species have found wide application in dermatology. In Saudi Arabia, this plant is a popular remedy for the treatment of ulcers, leprosy, boils, and skin itching (Mossa et al., 1987; Al-Shanwani, 1996). In many regions of India, the leaves are also used for this purpose (Asolkar et al.,

1965–1981; Mali, 2010; Upadhyay, 2015; Chand et al., 2021). For example, in the Hassan district, it is used to treat skin rashes (Kumar and Shiddamallayya, 2016). In the Tirunelveli mountains, the Kani people prepare a paste from the leaves and castor oil, which is then applied to skin swellings and wounds (Ayyanar and Ignacimuthu, 2009). It is used in a similar way in West Bengal (Paria, 2005), Gujarat, and among the Khonds of the Paderu district (Nageswara Rao et al., 2022). Outside India, the use of powdered plant material has also been reported by the Tharu people in Nepal. This powder is primarily used to treat head wounds in children (Dangol and Gurung, 1991).

C. viscosa is often used to treat respiratory ailments. For example, in the Seychelles, decoctions are prepared from the leaves to treat coughs, while also serving as a refreshing drink (Gurib-Fakim and Brendler, 2004). According to Ayurvedic recommendations, this plant is primarily used as a remedy for bronchitis (Asolkar et al., 1965–1981; Chand et al., 2021). To alleviate chronic cough, the Nicobarese people of Little Andaman use an orally administered paste made from the leaves (Chander and Vijayachari, 2018). In the Philippines, the aromatic leaves are inhaled to relieve nasal congestion, while in Nepal, it is used similarly to relieve coughs (Dani and Tiwari, 2013). The use of volatile compounds in the treatment of respiratory ailments has also been reported in Mayotte, where crushed above-ground parts are used for inhalation (Huat et al., 2021). In Java, leaf-based preparations are used to treat respiratory ailments. These include milk-based drinks taken orally. The use of the plant in the treatment of respiratory ailments has also been reported in Australia (van Valkenburg and Bunyapraphatsara, 2001).

The whole plant, including its volatile compounds, is used in traditional medical cultures as a pain reliever. In tropical Africa, headaches are treated by inhaling vapours from infusions prepared from this plant. The leaves are also used in this region as compresses to relieve both headaches and rheumatic pain (Burkill, 1985; Grubben and Denton, 2004; Gurib-Fakim and Brendler, 2004). Throughout Southeast Asia, including the Philippines and Indonesia, the leaves are primarily applied as poultices. Here, too, as in tropical Africa, the herb is inhaled to help treat sinus headaches (Gurib-Fakim and Brendler, 2004; Williams, 2013). The use of poultices made from crushed leaves to relieve headaches has also been reported in Australia among Aboriginal communities (Packer et al., 2012; Williams, 2013; Yeshi et al., 2022).

Taken together, these properties support the plant's use in treating specific conditions, such as ear inflammation. *Cleome viscosa* is a popular remedy for this condition in both Africa and Asia. In Benin, decoctions of the whole plant are administered orally to treat this condition, suggesting a systemic, rather than local, effect (Adomou et al., 2012). In the Hijaz region of Saudi Arabia, leaf juice, mixed with water or ghee, is used as eardrops (Mossa et al., 1987). In India, for ear pain and infections, regional practices include applying leaf juice or leaf extracts. These treatments are popular in Gujarat, Rajasthan, Telangana, Haryana, Delhi Aravali, Uttar Pradesh, and Andhra Pradesh (Asolkar et al., 1965–1981; Bedi, 1978; Mali, 2010; Upadhyay, 2015; Srinivas Rao, 2016; Nageswara Rao et al., 2022). The plant is used similarly in the Nicobar Islands (Chander et al., 2014). In the Philippines, leaf juice from *C. viscosa*, mixed with coconut oil, is used as eardrops (Pardo de Tavera, 1901). Among the Thari people of the Nara Desert in Pakistan, leaf juice is used not only for ear infections and pain, but also for hearing loss (Qureshi and Bhatti, 2008).

The plant is also widely used to treat eye inflammation. In Java, a solution of *C. viscosa* leaf juice, mixed with milk or water, is applied (Flora Malesiana, 1960; van Valkenburg and Bunyapraphatsara, 2001). In India, this leaf juice is traditionally used to wash the eyes (Williams, 2013). Among the Khonds tribe in Paderu district, India, the leaf juice is applied directly to relieve toothache (Nageswara Rao et al., 2022).

In the context of the plant's analgesic properties, traditional use of *C. viscosa* for rheumatism

and related musculoskeletal disorders is consistent across cultures. In tropical parts of Africa, to alleviate rheumatic complaints, the fresh herb is rubbed into the affected skin (Grubben and Denton, 2004; Gurib-Fakim and Brendler, 2004). In India, the plant is widely used in traditional medicine for joint pain and inflammation. For this purpose, the leaves are applied topically as compresses, or as creams augmented with plant extract (Parimaladevi et al., 2003; Upadhyay, 2015; Chand et al., 2021; Mandal and Mukherjee, 2023). Similar uses occur throughout Southeast Asia. In Java, Malaysia, and the Philippines, the plant is used to treat rheumatism and unspecified local pain by rubbing it into the skin, or by applying leaf poultices (Flora Malesiana, 1960; Williams, 2013). The plant is used similarly in Australia by Aboriginal communities (Williams, 2013; Yeshi et al., 2022).

Across many cultures, *C. viscosa* is also used to treat gastrointestinal disorders, reflecting its recognised anti-diarrhoeal and hepatoprotective properties. For example, it is used to treat jaundice in Benin, and dysentery in Mauritius (Gurib-Fakim and Brendler, 2004; Adomou et al., 2012). The plant is also known in Saudi Arabia as a remedy for stomach disorders and poisoning accompanied by fever (Al-Shanwani, 1996). In India and Nepal, the Ayurvedic, Unani, and folk traditions recommend the use of *C. viscosa* in the treatment of liver diseases and ailments such as indigestion, diarrhoea, and dysentery (Asolkar et al., 1965–1981; Mali, 2010; Dani and Tiwari, 2013; Upadhyay, 2015; Chand et al., 2021). Traditional Indonesian medicine recommends decoctions of *C. viscosa* for internal use to treat colic and severe diarrhoea (Burkill, 1985). The use of *C. viscosa* in the treatment of digestive disorders also stems from its ability to treat parasitic infections. In Africa, both the roots and seeds of the plant are well-known remedies for intestinal parasites (Gurib-Fakim and Brendler, 2004; Adomou et al., 2012; Williams, 2013). In India, both the seeds and the oil extracted from them are known as anthelmintics (Asolkar et al., 1965–1981; Grubben and Denton, 2004; Mathur and Joshi, 2013;

Upadhyay, 2015; Chand et al., 2021). In the province of Karnataka, this property is particularly well known; uses also extend to the treatment of haemorrhoids (Mali, 2010; Kumar and Shiddamallayya, 2016). This anthelmintic use is further supported by identical practices reported on the remote island of Guam (Burkill, 1985).

Cleome viscosa is used in traditional medicine to treat gynaecological conditions. In Réunion, a hot decoction of the entire plant is consumed alongside *Euphorbia hirta* to address delayed menstruation (Lavergne and Véra, 1989). Similarly, in Saudi Arabia, this species is used to treat uterine pain and menstrual disorders (Al-Shanwani, 1996). This species is notable in obstetric medicine. In India, decoctions and infusions made from boiled leaves and roots are traditionally given to pregnant women to ease labour (Upadhyay, 2015). Beneficial effects on the female reproductive system have been documented in Oceania. In Papua New Guinea, women regularly chew *Cleome viscosa* leaves to increase fertility. It is often recommended to childless women, who consume it in combination with betel nuts (World Health Organization, 2009; Williams, 2013).

Given its many uses and presence in numerous local pharmacopoeias, it is employed to treat other conditions across regions. For instance, in Israel,

Cleome viscosa is included in traditional herbal remedies for diabetes (Mali, 2010; Williams, 2013). Within Ayurvedic and Unani medicine, this species is widely described as having neuroactive properties, and is recommended for treating infantile convulsions (Asolkar et al., 1965–1981; Chand et al., 2021). Additionally, in India and Sri Lanka, the plant's roots and seeds are considered cardiac stimulants, and are used to treat cardiac conditions (Mali, 2010; Williams, 2013; Ganesan and Kumaresan, 2017). Due to their stimulating properties, the seeds are also used to increase overall alertness and vitality (Mathur and Joshi, 2013). A noteworthy application of *Cleome viscosa* in traditional medicine has been reported on the Indonesian island of Morotai. The Galela and Tobelo tribes use a filtrate of brewed, crushed, and soaked leaves to treat leukaemia (Rahmayanti Adrias et al., 2021).

Commonly regarded as a remedy for a variety of ailments within its range, *Cleome viscosa* has been incorporated into ethnoveterinary traditions. In the Moradabad district of the Indian state of Uttar Pradesh, traditional healers (vaidyas and hakims) and elders use a paste made from the fresh leaves of this species as an ointment for animal wounds (Sharma et al., 2025). Pakistani shepherds employ the plant in a similar manner. In this case, dried, powdered plant material is used. Besides treating wounds in farm animals, the powder is applied to various skin conditions. It is sometimes administered internally to aid digestion (Hassan et al., 2022).

In addition to its food and medicinal uses, people in Niamey, Nigeria, use it as an insect repellent. For this purpose, the leafy stems of *Cleome viscosa* are burned as a fumigant to repel mosquitoes (Yolidje et al., 2020). In central Sumatra and parts of tropical Southeast Asia, dried and powdered leaves, mixed with seeds and tobacco, are used to enhance tobacco's stimulant effects (Flora Malesiana, 1960; Burkill, 1985; van Valkenburg and Bunyapraphatsara, 2001; Upadhyay, 2015). The seeds of this plant have reportedly been used as a form of currency in barter trade in the Garhwal Himalaya (India). For this purpose, *Cleome viscosa* seeds are measured in special baskets called 'Pathi', and exchanged for other products, such as cereal seeds (Maikhuri et al., 2000).

With considerable practical importance among many local communities, *Cleome viscosa* has also become part of various rituals and ceremonies related to local beliefs. For instance, in South Kordofan, Sudan, the root of the plant is placed in amulets worn as armbands. The armband is believed to protect the wearer from the evil eye (a belief in supernatural harm caused by envious or malevolent

gazing) (Issa et al., 2018).

Scientific perspective: Compared to other weeds, *Cleome viscosa* stands out due to its high levels of nutrients and bioactive compounds. Analyses show that the fresh leaves provide a moderate amount of protein (5.6 g per 100 g), and are a rich source of minerals and vitamins. These include calcium (880 mg per 100 g), phosphorus (73 mg per 100 g), iron (24 mg per 100 g), and ascorbic acid (204 mg per 100 g) (Grubben and Denton, 2004).

Nutritionally, the seeds are also worth considering. They contain more than 40% protein. The oil content of the seeds ranges from 18% to 37% and is characterised by a high proportion of unsaturated fatty acids. Linoleic acid accounts for up to 70% of

all fatty acids in the oil. The remaining fatty acids are oleic acid (14%), palmitic acid (10%), stearic acid (5%), and myristic acid (11.9%) (Grubben and Denton, 2004; Upadhyay, 2015).

The abundance of phytochemical compounds in *C. viscosa* confirms the plant's high pharmacological potential. In addition to the aforementioned fatty acids found in the oil, the seeds of this species are a rich source of coumarino-lignans, including cleomiscosins A–D, as well as notable flavanone glycosides, myristic acid, docosanoic acid, diterpenes (such as cleomeolide), and several unique compounds, including 7-phenoxycoumarin, cleosandrin, and the saponin stigmasta-5,24(28)-diene-3β-O-α-L-rhamnoside. The seeds also contain glucosinolates, including the methyl, benzyl, and 2-phenethyl types, as well as the flavonoid 5-O-methyl-eriodictyol-7-O-β-D-rhamnopyranoside (Burkill, 1985; Maikhuri et al., 2000; Grubben and Denton, 2004; Upadhyay, 2015).

As with the roots, the above-ground parts of the plant are rich in secondary metabolites. These include a variety of flavonoids, such as quercetin and kaempferol derivatives, as well as viscoseosides, astragalin, kaempferitrin, glycosides, saponins, steroids, tannins, and terpenoids (Burkill, 1985; Chand et al., 2021). Additionally, the entire plant has been shown to contain polyphenolic acids, including gallic acid, protocatechuic acid hexoside, chlorogenic acid, catechin, p-hydroxybenzoic acid, and p-coumaric acid. These compounds are known for their antioxidant and antidiabetic properties, as reflected in traditional uses (Yarrappagaari et al., 2022).

The rich phytochemical composition of the plant, as described above, is reflected in its traditional uses, the validity of which has largely been confirmed in laboratory settings. Among the properties most valued by local communities is its analgesic effect. Studies on aqueous and methanol extracts from the seeds have confirmed significant, dose-dependent analgesic effects in mice, involving both peripheral and central mechanisms of action. These studies indicate that the effect is comparable to that of standard pharmaceutical analgesics (Parimaladevi et al., 2003; Chand et al., 2021).

The anti-inflammatory properties of *C. viscosa* have also been confirmed: methanol extracts were found to effectively reduce carrageenan-induced paw oedema in rats. These results support traditional medicinal use for inflammatory conditions (Chand et al., 2021). The extract also exhibited significant antipyretic activity, alleviating yeast-induced fever in rats at doses ranging from 200–400 mg/kg body weight. Studies on the antipyretic efficacy of this extract have shown results comparable to those obtained with paracetamol (Asolkar et al., 1965–1981).

Experimental studies also confirm the antidiarrhoeal effect of *C. viscosa* plant extracts (Grubben and Denton, 2004; Chand et al., 2021). Coumarino-lignans (particularly cleomiscosins) isolated from the seeds have also demonstrated hepatoprotective effects in rat models (Grubben and Denton, 2004; Chand et al., 2021). Subsequent studies have shown that seed extracts exhibit strong activity against helminths, i.e., parasitic worms, thus confirming their traditional use in folk medicine for treating parasitic infections and reducing fever (Williams, 2013; Upadhyay, 2015). As for antibacterial activity, aqueous extracts from the above-ground parts of the plant have been shown to completely inhibit the growth of *Aeromonas hydrophila*, which causes gastroenteritis, and *Bacillus cereus*, which causes food poisoning (Gurib-Fakim and Brendler, 2004).

Furthermore, studies have shown that polyphenols and flavonoids found in the plant are responsible for its cytotoxic properties and moderate anti-tumour activity (Gurib-Fakim and Brendler, 2004; Williams, 2013). Methanolic extracts from this plant, which are rich in polyphenolic compounds, show potent antihyperglycaemic and antidiabetic properties. These effects are associated with the inhibition of α-glucosidase and α-amylase, as well as reduced non-enzymatic glycosylation of haemoglobin. These findings support reports from Israel of the traditional use of the plant in treating diabetes (Mali,

2010; Yarrappagari et al., 2022).

The strong antioxidant activity of *Cleome viscosa* has been shown in both *in vitro* and *in vivo* studies. These effects are attributed to its high content of phenolic and flavonoid compounds, including gallic acid, catechin, and quercetin (Chand et al., 2021; Yarrappagari et al., 2022). In addition to immunomodulatory and gastroprotective effects, the extracts also show psychopharmacological properties, i.e., calming and muscle-relaxant effects (Williams, 2013; Chand et al., 2021). The effectiveness of the traditional use of the plant in treating skin problems has been shown in laboratory studies. Topical application of methanolic extracts significantly promotes the repair of skin damage (Parimaladevi et al., 2003; Williams, 2013).

Finally, the plant has been reported to exhibit insecticidal and repellent properties (Gurib-Fakim and Brendler, 2004; Upadhyay, 2015). Smoke from burning the plant's leaves has been reported to be effective against the larvae of *Anopheles stephensi*, the main malaria vector. This is relevant to the population of Niamey in Niger, who have traditionally used burnt leaves of this plant to fumigate against mosquitoes for generations (Williams, 2013; Bansal et al., 2014; Upadhyay, 2015; Yolidje et al., 2020).

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